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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

The National Aeronautics and Space Administration makes the results of worldwide research and development activities in aeronautics, space, and supporting disciplines promptly available to participants in its programs. NASA's scientific and technical information system now contains nearly a million documents, which are abstracted, indexed, and obtainable through retrieval and dissemination services. These services, which include this abstract journal, *Scientific and Technical Aerospace Reports (STAR)*, are described in a bulletin, *The NASA Scientific and Technical Information System . . . and How to Use It*, available at no charge from the NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

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STAR is a comprehensive abstracting and indexing journal covering current worldwide *report* literature on the science and technology of space and aeronautics. Publications abstracted in *STAR* include scientific and technical reports issued by NASA and its contractors, other U.S. Government agencies, corporations, universities, and research organizations throughout the world. Pertinent theses, translations, NASA-owned patents and patent applications, and other separate documents are also abstracted. Citations and abstracts in *STAR* are grouped in 34 subject categories, although accession numbers run in unbroken sequence through the *STAR* issues, without regard to category assignment.

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Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts (IAA)* provides parallel coverage of scientific and trade journals, books, and conference papers in the same subject areas as *STAR*. *STAR* and *IAA* are categorized and abstracted in basically identical ways, and documents in both are indexed by terms from the *NASA Thesaurus*. Both journals appear twice monthly, *IAA* being issued on the 1st and 15th of each month.

IAA is available on subscription from the American Institute of Aeronautics and Astronautics. Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

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Cumulated index volumes: United States and possessions, $75 postpaid; foreign countries, $90 postpaid.

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Scientific and technical reports produced by NASA and its contractors and grantees, or in conjunction with other Government agencies, and other selected documents released by NASA are identified by an asterisk (*) following the accession numbers (e.g., N72-10748*). Prior to their announcement in *STAR*, these NASA publications are assigned a specific NASA report number, which is shown on the last line of the *STAR* citation. The nature of NASA publications is specified by the report number series, identified by a prefix to the report number: TR-R, TN-D, TM-X, TT-F, CR, or SP. These series refer respectively to NASA Technical Reports, which contain significant and complete contributions to scientific and technical knowledge; Technical Notes, reports of similar quality by lesser scope; Technical Memorandums, reports containing preliminary data or of specialized utility; Technical Translations, information published in a foreign language and considered to merit NASA distribution in English; Contractor Reports, information generated under NASA-sponsored contracts, grants, or interagency agreements; and Special Publications, which include conference proceedings, monographs, data compilations, sourcebooks, special bibliographies, and other publications derived from or of value to NASA activities. Reports in these series that are printed by NASA are often referred to as "low numbered" or "low series" publications, because the report number is always below 50,000 (8,000 for Technical Translations). Some TM-X and CR reports are numbered above 50,000. These, and TT-F translations above 8,000, are referred to as "high-numbered" or "high series" publications, and are generally available only in microfiche[1] or facsimile reproductions.

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Facsimile copy or microfiche of NASA and NASA-sponsored documents identified by both the symbols # and * and those AGARD reports that are on microfiche may be purchased from:

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In the citation of each NASA-supported document and of some non-NASA documents is a code (e.g., CSCL 25A) that indicates the subject category assigned to it from the COSATI Subject Category List (first ed. December, 1964) published by the Committee on Scientific and Technical Information of the Federal Council for Science and Technology.

INDEXING VOCABULARY

The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA*

Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

ADDRESSES OF ORGANIZATIONS

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and Astronautics
Technical Information Service
750 Third Ave.
New York, N.Y. 10017

Commissioner of Patents
U.S. Patent Office
Washington, D.C. 20231

ESRO/ELDO Space Documentation Service
European Space Research Organization
114, av. Charles de Gaulle
92-Neuilly-sur-Seine, France

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601 E. Cedar Avenue
Flagstaff, Arizona 86002

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey
Bldg. 25, Denver Federal Center
Denver, Colorado 80225

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mentation und -Information
8 München 86
Postfach 880
Federal Republic of Germany

Volume 10 Number 11 / June 8, 1972

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Subject Categories

Abstracts in the journal are grouped under the following categories:

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01 Aerodynamics 1417
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 1419
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 1423
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 1424
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 1431
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 1435
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1436
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 1442
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 1445
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 1447
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 1451
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 1454
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 1465
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 1470
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 1479
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 1483
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 1484
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 1487
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 1489
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1491
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1495
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1498
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1500
Includes acoustics, Cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 1502
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 1508
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 1514
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 1518
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

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28 Propulsion Systems 1518
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1520
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1522
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1526
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1538
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1541
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 1544
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

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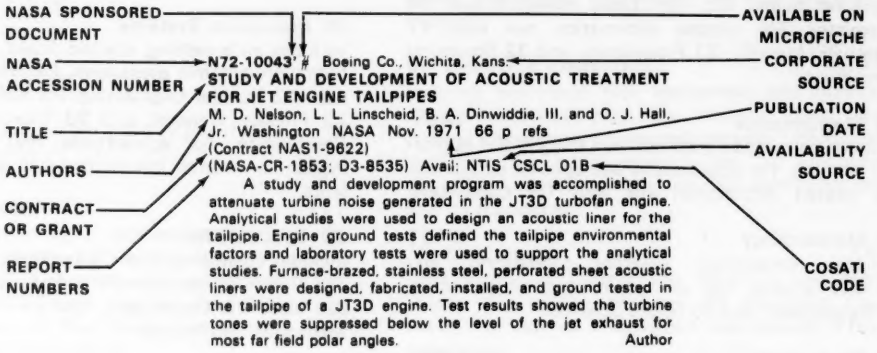
TYPICAL CITATIONS AND ABSTRACTS

NASA CONTRACTOR REPORT CITATION AND ABSTRACT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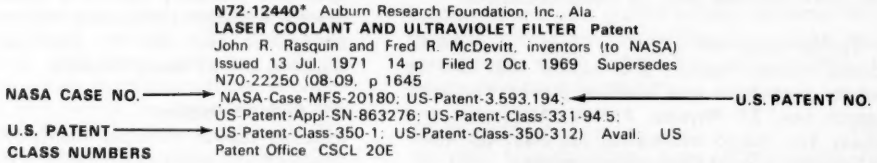
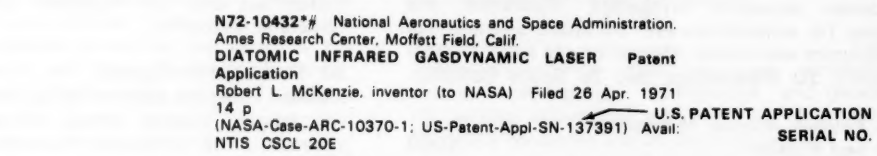
PUBLICATION DATE
AVAILABILITY SOURCE
COSATI CODE
N72-10043* # Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles.
Author

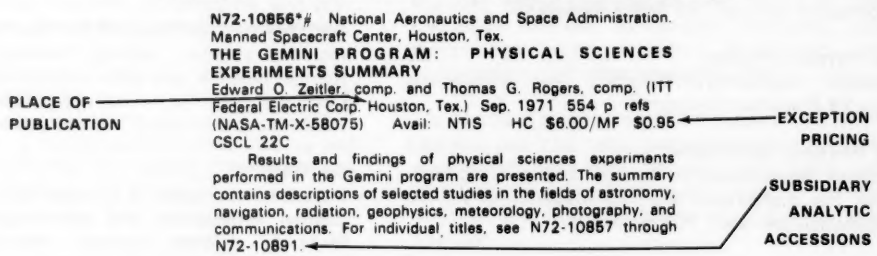
PATENT CITATION


NASA CASE NO.
U.S. PATENT CLASS NUMBERS
U.S. PATENT NO.
N72-12440* Auburn Research Foundation, Inc., Ala
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION


U.S. PATENT APPLICATION SERIAL NO.
N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

PRIMARY ANALYTIC CITATION AND ABSTRACT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N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp. Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C
Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

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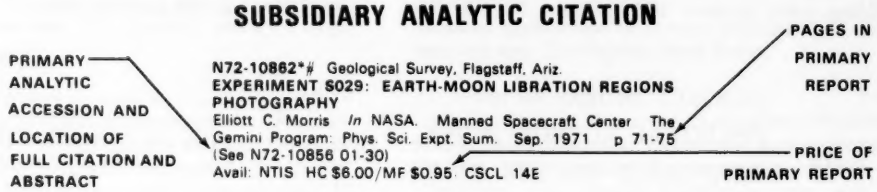
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EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-19991*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A 1380-FOOT-PER-SECOND-TIP-SPEED AXIAL-FLOW COMPRESSOR ROTOR WITH A BLADE TIP SOLIDITY OF 1.3
Roy D. Hager, David C. Janetzke, and Lonnie Reid Washington Apr. 1972 95 p refs
(NASA-TM-X-2448; E-6503) Avail: NTIS CSCL 21E

Aerodynamic design parameters are presented along the overall and blade element performance, of an axial flow compressor rotor designed to study the effects of blade solidity on efficiency and stall margin. At design speed the peak efficiency was 0.844 and occurred at an equivalent weight flow of 63.5 lb/sec with a total pressure ratio of 1.801. Design efficiency, pressure ratio, and weight flow 0.814, 1.65, and 65.3(41.1 lb/sec/sq ft of annulus area), respectively. Stall margin for design speed was 6.4 percent based on the weight flow and pressure ratio values at peak efficiency and just prior to stall. Author

N72-19992# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENT OF THE DRAG ASSOCIATED WITH RECESSED SURFACES: CUTOUTS OF RECTANGULAR AND ELLIPTICAL PLANFORM
H. Friesing Oct. 1971 21 p Transl. into ENGLISH from German report FB-628
(RAE-Lib-Trans-1614; FB-628; BR-28184) Avail: NTIS

Little is known about the drag associated with recessed surfaces or cut-outs on the wings and fuselage of an aircraft. Systematic drag measurements have been carried out on eight cut-out models, of rectangular and elliptical planform with aspect ratios between 1:6 and 1:1 for various depths of the cut-outs. Pressure distributions on the walls of the cut-outs were also measured. The measurements described were carried out on fairly small models. They were designed to serve only as a first guide, as it is proposed to carry out tests on larger models. Author

N72-19993*# Scientific Translation Service, Santa Barbara, Calif.
UNSOLVED PROBLEMS OF AIRPLANE AERODYNAMICS
J. Barche Washington NASA Mar. 1972 51 p Transl. into ENGLISH of Offene Probleme der Flugzeug-Aerodynamik Presented at 4th Ann. Meeting of DGLR, Baden-Baden, W. Germany, 11-13 Oct. 1971
(Contract NASw-2035)
(NASA-TT-F-14208) Avail: NTIS CSCL 01A

Problems inherent in current and future aircraft design which still lack a solution as a result of gaps in the theoretical and experimental description of flow patterns are discussed. Both civil and military aircraft in the subsonic and transonic range are considered. Problems arising in different phases of aerodynamic design are examined first. Next, special flow problems encountered during different flight phases, such as takeoff and landing, during transonic flight, and during flight maneuvers, are characterized and explained. Author

N72-19994*# Scientific Translation Service, Santa Barbara, Calif.
THE SUPERCRITICAL WING
D. Seidl Washington NASA Mar. 1972 14 p Transl. into ENGLISH from Flug-Rev. Int. (West Germany), no. 2, Feb. 1972 p 40, 42, 44, and 46
(Contract NASw-2035)
(NASA-TT-F-14242) Avail: NTIS CSCL 01A

Flow phenomena encountered in the vicinity of Mach 1 are discussed. The application of the supercritical wing to this flight regime are discussed. Research work and flight tests performed by various American companies are detailed. Author

N72-19995# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
CALCULATION OF BODY INTERFERENCE LOADS FOR WING-BODY COMBINATIONS AT MACH NUMBERS 1.59 TO 7.15 WITH SUPERSONIC LINEAR THEORY, PART 1
S. Anders and L. Gustavsson 1971 29 p refs
(FFA-AU-635-Pt-1) Avail: NTIS

Loads on slender bodies with wings of small aspect ratios were computed with Woodwards panel method, based on linearized theory for supersonic flow. The calculations are made for Mach numbers between 1.59 and 7.15. The obtained total loads and body interference loads due to the wing compare well with experimental values. The largest difference obtained for the interference load was less than 25%. Even for this extreme case the center of pressure position was well predicted. As the interference load itself was only some 20% of the total load for these configurations, it was concluded that the computations of the body interference load are sufficiently accurate for design purposes. Author

N72-19996# Max-Planck-Institut fuer Stromungsforschung, Gottingen (West Germany).
EXPERIMENTAL STUDY OF TRANSONIC POTENTIAL FLOW AROUND A SYMMETRICAL WING PROFILE [EXPERIMENTELLE UNTERSUCHUNG EINER TRANS-

SONISCHEN POTENTIALSTROEMUNG UM EIN SYMMETRISCHES TRAGFLUEGELPROFIL]
W. J. Hiller and G. E. A. Meier Nov. 1971 25 p refs In GERMAN
(Rept-10/1971) Avail: NTIS

The transonic potential flow around a symmetric quasi-elliptical wing profile is investigated, in order to determine whether shockless compression is physically realizable. The experiment was carried out in a wind tunnel using a Mach-Zehnder interferometer and photographic equipment to record the interference patterns. Pressure distribution along the profile are computed from the interferograms. The results, compared with theoretical calculations, generally agree, but a detailed consideration differs in that the compression shock coming from the profile's leading edge prevents the expected underpressure scale to build up, and thus the formation of the calculated flow field. ESRO

N72-19997# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aeroelastik.
CALCULATION OF THE UNSTEADY PRESSURE DISTRIBUTION ON HARMONICALLY OSCILLATING SLENDER WING FUSELAGE CONFIGURATIONS
K. Chao Cologne DGLR Aug. 1971 34 p refs In GERMAN; ENGLISH summary Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
(AVA-FB-7126) Avail: NTIS

Based upon the slender-body-theory, the pressure distribution on harmonically oscillating wing-fuselage configurations is calculated numerically. The configurations consist of a circular cylindrical fuselage body with a conical nose and a delta wing of various leading edges (straight, cubic, and sinusoidal). The influences of the fuselage, wing geometry, and the reduced frequency are investigated. For three delta wings with straight leading edges, the results are compared with the corresponding results obtained from three dimensional lifting surface theory.
Author (ESRO)

N72-19998# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Gasdynamik.
FORCE AND PRESSURE DISTRIBUTION MEASUREMENTS ON A WING-BODY COMBINATION WITH WING OF LOW ASPECT RATIO IN COMPRESSIBLE FLOW
W. Stahl, K. Hartmann, and W. Schneider Cologne DGLR Aug. 1971 39 p refs In GERMAN; ENGLISH summary Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
(AVA-FB-7129) Avail: NTIS

Transonic wind tunnel experimental investigations were carried out on a wing-body combination, with a delta wing of low aspect ratio (lambda = 0.52). The wing extended along most of the length of the body, which was a circular cylinder with an ogival nose. Mach numbers ranged from M infinity = 0.5 to 2.2, covering the transonic regime. Normal forces and pitching moments were measured, as well as spanwise pressure distributions in several sections on the pressure and suction sides. Oil flow and smoke pictures gave some insight into the flow field. The Reynolds number, formed with 2/3 of the length of the wing, was held constant at Re = 2,700,000 for all Mach numbers. The influence of the Reynolds number was investigated at Mach numbers M infinity = 0.5, 1.0., and 1.8.
Author (ESRO)

N72-19999# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
HEAT ADDITION IN SUPERSONIC FLOW BY MEANS OF HYDROGEN COMBUSTION ON A FLAT PLATE IN TANGENTIAL FLOW
F. Maurer Cologne DGLR 1971 63 p refs In GERMAN; ENGLISH summary Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The problem of external heat addition in supersonic flow for producing aerodynamic forces is studied, supplemented by a one dimensional momentum analyses for the flowfield of a flat plate in tangential flow. Secondary air injection through a slot nozzle is used for creating upstream and downstream recirculation zones. By adding hydrogen to the upstream flow and igniting with a spark device, a stable flame is produced. The magnitude of the upstream recirculation zone is increased and, the point of boundary layer separation is shifted upstream. Pressure distributions are measured to give information on the acting crossforces. Schlieren and flame picture flow models help to estimate these forces for engineering purposes. Author (ESRO)

N72-20000# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Porz (West Germany).
INVESTIGATIONS OF THE DRAG BEHAVIOR OF BUNDLED BODIES OF REVOLUTION IN LONGITUDINAL FLOW AT MACH 1.5 TO 4.0 [UNTERSUCHUNGEN UEBER DAS WIDERSTANDSVERHALTEN LAENGS ANGESTROEMTER, GEBUENDELTER ROTATIONSKOERPER IM GESCHWINDIGKEITSBEREICH MACH 1,5 - 4,0]
Wolfgang Langefeld 1971 23 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

In view of the development of Europa launch vehicles with external parallel bundled boosters, hypersonic wind tunnel measurements have been carried out on bundled bodies of revolution, in order to assess the total drag. Results of these measurements are given, and include the wave drag, friction drag, far end drag, and interference drag coefficients, for the separate parts of the bundle and also for the combination.
ESRO

N72-20001# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
EXPERIMENTAL INVESTIGATIONS OF THE AERODYNAMIC COEFFICIENTS OF A BODY-WING COMBINATION AND COMPARISON WITH RESULTS OF LINEAR AND NONLINEAR THEORIES FOR SUBSONIC SPEEDS [EXPERIMENTELLE UNTERSUCHUNGEN AERODYNAMISCHER BEIWERTE EINER FLUEGEL-RUMPF-KOMBINATION UND VERGLEICH MIT DEN RESULTATEN LINEAR ER UND NICHTLINEARER THEORIEN BEI UNTERSCHALLGESCHWINDIGKEITEN]
E. Herpfer and J. T. Heynatz 1971 66 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A comparison is made of different methods to calculate the most important aerodynamic coefficients of the longitudinal, lateral, and rolling motion of a wing-body combination with large angle of attack and small sideslip angle. Using results of experiments in compressible and incompressible flow, the applicability and reliability of the methods are discussed. While linear theories are only applicable for angles of attack less than 5 deg, the nonlinear methods give good results for angles of attack up to 12 deg. For larger angles the other theories fail to be applicable. In order to discuss the wing-body combination, the wing and the body, including their vortex models, are separately treated. ESRO

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-20002+ Rheinstahl A.G., Dortmund (West Germany).
TOW PLANE FOR GLIDERS [SCHLEPPFLUGZEUG FUER SEGELFLUGZEUGE]
K. Mink Cologne DGLR 1971 6 p In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The design of a propeller driven light aircraft for the towing of gliders is discussed. The elevators are front mounted, and the propeller is tail mounted, in push fashion. The tow cable protrudes through the aircrew shaft. The propeller drive is an automobile engine. ESRO

N72-20003# Seagram (Joseph E.) and Sons, Inc., New York.
THE MAINTENANCE DEPARTMENT INSPECTION PROGRAM
Jon M. Rives [1971] 6 p Presented at the 7th Ann. FAA Intern. Aviation Maintenance Symp.
Avail: NTIS

The establishment of a continuous inspection and maintenance schedule for determining the airworthiness of aircraft is discussed in terms of changes to current FAR that direct the operators to follow the manufacturer's recommended procedures. It is concluded that the proposed FAR change allows maintenance managers to actually manage the maintenance to suit their requirements and still have an airworthy aircraft. F.O.S.

N72-20004# Eastern Air Lines, Inc., Miami, Fla.
B747 PERSONALIZED MAINTENANCE APPROACH
Frederick J. Lind 7 Dec. 1971 8 p
Avail: NTIS

The Eastern Airlines maintenance program for the Boeing 747 aircraft is described along with personnel training. The personalized approach is illustrated by showing the activities of maintenance personnel on the JFK-SJU turn around flight. F.O.S.

N72-20005*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GROUND NOISE MEASUREMENTS DURING FLYOVER HOVER, LANDING, AND TAKE-OFF OPERATIONS OF A STANDARD AND A MODIFIED HH-43B HELICOPTER
David A. Hilton, Herbert R. Henderson, and Robert J. Pegg Washington Feb. 1971 40 p refs
(NASA-TM-X-2226; L-7237) Avail: NTIS CSCL 01B

A field noise measurement program has been conducted on a standard HH-43B helicopter and one that had been modified by reducing the rotor speed, altering rotor tip shape, and treating the engine exhaust and inlet to reduce the external noise levels. The modifications were limited to those which could easily be made on a standard helicopter; consequently, only modest noise reductions were expected. The ground noise characteristics of each helicopter during flyby, hover, landing, and take-off operations are presented. Based on an analysis of the measured results, the average of the overall on-track noise levels of the modified helicopter was approximately 3 dB lower than for the standard helicopter. Narrow-band-spectra data of the hovering helicopter show a reduction in the overall noise due to the engine exhaust and a general reduction in harmonic content throughout the spectrum for the modified helicopter. The noise results of the test program are found to correlate generally with previous noise measurements on this type of aircraft, and the noise reductions are within a range expected from the modifications which were incorporated. Author

N72-20006*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEFINITION AND APPLICATION OF LONGITUDINAL STABILITY DERIVATIVES FOR ELASTIC AIRPLANES
William B. Kemp, Jr. Washington Mar. 1972 119 p refs
(NASA-TN-D-6629; L-8050) Avail: NTIS CSCL 01A

A set of longitudinal stability derivatives for elastic airplanes is defined from fundamental principles allowing perturbations in forward speed. Application of these derivatives to longitudinal stability analysis by use of approximate expressions for static stability and control parameters as well as the dynamic equations of motion is illustrated. One commonly used alternative formulation for elastic airplanes is shown to yield significant inaccuracies because of inappropriate interpretation of inertial effects. Author

N72-20007*# Research Triangle Inst., Durham, N.C.
INVESTIGATION OF THE PERFORMANCE CHARACTERISTICS OF DOPPLER RADAR TECHNIQUE FOR AIRCRAFT COLLISION HAZARD WARNING, PHASE 3
Washington NASA Mar. 1972 151 p refs
(Contract NAS1-7537)
(NASA-CR-2020) Avail: NTIS CSCL 01B

System studies, equipment simulation, hardware development and flight tests which were conducted during the development of aircraft collision hazard warning system are discussed. The system uses a cooperative, continuous wave Doppler radar principle with pseudo-random frequency modulation. The report presents a description of the system operation and deals at length with the use of pseudo-random coding techniques. In addition, the use of mathematical modeling and computer simulation to determine the alarm statistics and system saturation characteristics in terminal area traffic of variable density is discussed. Author

N72-20008*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL CRUISE TRAJECTORIES FOR SUPERSONIC AIRPLANES
Fred Teren and Carl J. Daniele Washington Mar. 1972 32 p refs
(NASA-TN-D-6707; E6506) Avail: NTIS CSCL 01B

Equations are derived for maximizing range for specified initial and final values of mass and altitude. Constant-velocity flight is assumed, and normal acceleration is neglected. The problem is solved by using the maximum principle. Optimal trajectories are obtained and uniqueness is demonstrated. Results are obtained for a supersonic airplane. Curves are presented which can be used to obtain the optimal trajectory and maximum range for a range of initial and final mass and altitude. The optimal range is compared to the range obtained by using the standard cruise trajectory profile (consisting of a Bereguet cruise plus maximum- and minimum-thrust connecting segments) and to the range obtained at constant-altitude cruise. Author

N72-20009# Grumman Aerospace Corp., Bethpage, N.Y. Fluid Dynamics Section.
REDUCTION OF HYPERVELOCITY HEATING WITH ELLIPTICAL LEADING EDGES
D. Weiss Feb. 1972 29 p refs
(RE-422) Avail: NTIS

Elliptical shapes are considered for use on wing and fin leading edges and fuselage chines in hypervelocity flight. Calculated distributions of heating rates and radiation equilibrium temperatures are presented for a family of ellipses at 0 and 60 degree angles of attack. Heating rates were obtained with a finite difference solution to the laminar compressible boundary

layer equations combined with an empirically derived inviscid pressure law for two dimensional flow around elliptical cylinders. The assumption implied by this pressure law of perpendicularity between a straight stagnation streamline and the local surface of the ellipse, is discussed. Reduction of peak heating rates from circular values is shown up to 17 percent with a blunt ellipse of axis ratio 0.6 at zero angle of attack, and 14 percent with a sharp ellipse of axis ratio 1.6 at 60 degree angle of attack for the reentry condition studied. This represents a 140 R drop in the radiation equilibrium wall temperature (with 0.8 emissivity) for zero attack angle, and 100 R drop for 60 degree attack angle. The calculated temperature distributions are also used to find shapes having minimum surface area requiring protection above certain temperatures. Author

N72-20010# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

SIMULATION STUDY OF THE FLYING QUALITIES OF A REMOTE CONTROLLED LIFTING BODY

W. Schattenmann Oct. 1971 36 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-82) Avail: NTIS; DFVLR Porz-Whan: 11.80 DM

A simulation was carried out in order to prove the remote control concept of the lifting body model Bumerang. For this purpose a display was developed showing the contours of the lifting body in a simplified manner. The remote controller was to read five motion variables. It was found that the pilot encountered certain difficulties in roll control. It was possible to reduce these by diminishing the control effectiveness. The characteristics of the control loop roll angle to aileron were analyzed theoretically. Author

N72-20011*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NOISE MEASUREMENTS OF MODEL JET-AUGMENTED LIFT SYSTEMS

Frederick W. Gibson Washington Apr. 1972 36 p refs

(NASA-TN-D-6710; L-8187) Avail: NTIS CSCL 01B

Noise measurements were obtained on models of jet-augmented lift systems which are currently being considered for use on proposed short takeoff and landing vehicles. These configurations included a conventional internally blown flap, an augmenter wing, an externally blown flap, and modifications of these basic concepts. The tests were conducted in the Langley anechoic noise facility at zero forward speed with cold air jets. The conventional internally blown flap exhibited lower noise levels than the augmenter wing and the externally blown flap at the same pressure ratios, being of the order of 8 dB or more at the lowest pressure ratio and of the order of 20 dB at the highest pressure ratio of the tests. The data also indicated that for the conventional internally blown flap, there may be an optimum gap size (other than zero) between the turning lip and the flap leading edge from the standpoint of minimum noise generation or admittance. Increasing the trailing-edge thickness of the plain internally blown flap produced no appreciable change in the overall sound pressure level or frequency spectral content in the range of the tests. The data indicated that at a position on the ground directly under the jet exit, the externally blown flap and the augmeter-wing overall noise levels are comparable to each other throughout the pressure range of the tests. Author

N72-20012*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A FLIGHT EVALUATION OF VTOL JET TRANSPORT UNDER VISUAL AND SIMULATED INSTRUMENT CONDITIONS

Curt A. Holzhauser, Samuel A Morello, Robert C. Innis, and James M. Patton, Jr. Washington Mar. 1972 95 p refs

(NASA-TN-D-6754; A-4023) Avail: NTIS CSCL 01B

A flight investigation was performed with the Dornier DO-31 VTOL to evaluate the performance, handling qualities, and operating characteristics that are considered to be important in the operation of a commerical VTOL transport in the terminal area. The DO-31, a 20,000 kilogram transport, has a mixed jet propulsion system; main engines with nozzles deflect from a cruise to a hover position, and vertical lift engines operated below 170 knots. This VTOL mode incorporates pitch and roll attitude and yaw rate stabilization. The tests concentrated on the transition, approach, and vertical landing. The mixed jet propulsion system provided a large usable performance envelope that enabled simulated IFR approaches to be made on 7 deg and 12 deg glide slopes. In these approaches management of thrust magnitude and direction was a primary problem, and some form of integrating the controls will be necessary. The handling qualities evaluation pointed out the need for additional research of define flight path criteria. The aircraft had satisfactory control and stability in hover out of ground effect. The recirculation effects in vertical landing were large below 15 meters. Author

N72-20013# Royal Aircraft Establishment, Farnborough (England).

DEVELOPMENT OF THE FA-200XS EXPERIMENTAL AIRCRAFT

Jiro Terao Dec. 1972 42 p refs Transl. into ENGLISH from Natl. Aerospace Lab., Japan, report TR-229

(RAE-Lib-Trans-1606; TR-229; BR-28319) Avail: NTIS

The FA-200XS is an experimental plane being developed to investigate the operational problems of STOL type airplane. The plane is generally similar to the original FA-200 (Aerobatic Category Certification) light airplane, but is equipped with full span slats and flaperons, as well as a boundary layer control system using distributed area suction located on the leading edges of flaps and ailerons. The experiments for the developments consisted of two and three-dimensional wind tunnel tests, and several series of flight tests to investigate the aerodynamic characteristics of the FA-200X and FA-200XS. Author

N72-20014*# Scientific Translation Service, Santa Barbara, Calif.

REFLECTIONS ON THE SOVIET SUPERSONIC AIRLINER TU 144

P. Bork Washington NASA Mar. 1972 23 p Transl. into ENGLISH from Tech.-Okonomische Inform: der Zivilen Luftfahrt, v. 7, no. 9, 1971 p 397-410

(Contract NASw-2035)

(NASA-TT-F-14206) Avail: NTIS CSCL 01B

The problems encountered during the design of the Tu 144 are considered. The cruising speed was limited to a range from 2300 to 2500 km/hr in order to avoid the great expenses inherent in the development of an aircraft based entirely on titanium alloys. The selection of the jet engine type is discussed together with the aerodynamic characteristics, stabilization and control, the aerodynamic design of the propulsion system, the wing structure, the landing gear, and the operation of the aircraft. Author

N72-20015*# Scientific Translation Service, Santa Barbara, Calif.

CURLING OF AN UNSTABLE DISCONTINUITY SURFACE Ph.D. Thesis

H. Kaden Washington NASA Mar. 1972 51 p refs Transl. into ENGLISH from Ing.-Arch. (Berlin), v. 2, 1931 p 140-168

(Contract NASw-2035)

(NASA-TT-F-14230) Avail: NTIS CSCL 20D

The unstable vortex layer behind a wing is analyzed using conformal mapping techniques. A plane discontinuity model is developed and the rolling-up process of the surface is studied. Applications to airfoil wing theory are given. A corresponding flow visualization experiment in a water tank is described. Author

N72-20016*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

IMPROVED LIFE RAFT STABILIZER Patent Application

Matthew I. Radnofsky, James H. Barnett, Jr., Floyd L. Harrison, and Ralph J. Marak, inventors (to NASA) Filed 30 Nov. 1971 10 p
(NASA-Case-MSC-12393-1; US-Patent-Appl-SN-203405) Avail: NTIS CSCL 06G

An improved life raft stabilizer has been designed for reducing rocking and possible capsizing. The stabilizer may be removably attached to the raft and is defined by flexible walls which extend a considerable depth downward into the water. The side walls, in conjunction with the floor of the raft, form a ballast enclosure. A weight is disposed in the bottom of the enclosure and water ports are provided in the walls. Placement of the stabilizer in the water allows the weighted bottom to sink, and water entering through the ports forms a ballast for the raft.
NASA

N72-20017# Transportation Systems Center, Cambridge, Mass.
VORTEX SENSING TESTS AT NAFEC Technical Report, 15 Jun. - 15 Jul. 1971
D. Burnham, J. Hallock, R. Kodis, and T. Sullivan Jan. 1972 70 p
(DOT-TSC-FAA-72-2) Avail: NTIS

Tests to determine and evaluate some of the characteristics of three experimental techniques for the remote sensing of wing tip vortices generated by heavy commercial and military aircraft are described. The techniques involved: (1) a pulsed, bistatic acoustic detection and ranging system, (2) a ground level pressure sensor, and (3) a ground level hot-wire anemometer. Results in the form of altitudes and times of tower hits and vortex tracks are presented.
Author

N72-20018# Transportation Systems Center, Cambridge, Mass.
REAL-TIME SIMULATION PROGRAM FOR DEHAVILLAND (CANADA) BUFFALO AND TWIN OTTER STOL TRANSPORTS
R. A. MacDonald (Serv. Technol. Corp., Cambridge, Mass.), Mel Garelick (Serv. Technol. Corp., Cambridge, Mass.), and J. Haas 25 Jun. 1971 56 p refs
(DOT-TSC-FAA-71-14) Avail: NTIS

Simulation models of two representative STOL aircraft, the DeHavilland Buffalo and Twin Otter transports have been generated. The aircraft are described by means of non-linear equations that will accomodate gross changes in angle of attack, pitch angle, flight path angle, velocity, and power setting. Aircraft motions in response to control inputs and external disturbances are related to Earth-fixed coordinates. The equations are programmed to run in real time so that they can be used in conjunction with a manned cockpit simulator. Provisions are made for pilot control inputs to the simulation, and conventional panel display parameters are generated. Representative simulation results which demonstrate that the simulation is an adequate representation of the two STOL aircraft being modeled are provided.
Author

N72-20019# Transportation Systems Center, Cambridge, Mass.
SIMULATION MODEL FOR THE PIPER PA-30 LIGHT MANEUVERABLE AIRCRAFT IN THE FINAL APPROACH
Joseph S. Koziol, Jr. Jun. 1971 29 p refs
(DOT-TSC-FAA-71-11) Avail: NTIS

The PA-30 aircraft and a representative autopilot during the final approach configuration are discussed for simulation purposes. The aircraft is modeled by linearized six degree of freedom perturbation equations referenced to the aircraft stability axis. Other equations are presented which derive the body axis rates, velocities and accelerations, and ground referenced velocities. The autopilot is a representative system for automatic instrument landing system approaches from initial localizer track down to decision height. Requirements for an instrument landing system and a generalized set of equations for aircraft approach under instrument conditions were developed.
Author

N72-20020# Federal Aviation Administration, Washington, D.C.
REVIEW OF AVIATION ACTIVITY IN 1971 AND THE OUTLOOK FOR 1972
14 Dec. 1971 7 p
(Rept-72-00207) Avail: NTIS

The FAA Office of Aviation Economics has reviewed aviations activity for the year 1971 and forecasts an optimistic trend in domestic and international air traffic operations, passenger utilization, and general aviation aircraft production for 1972. A special summary is included covering year end activities for the National Capital Airports of Dulles and National.
A.L.

N72-20021# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT US CIVIL AVIATION. ISSUE NO. 2: 1970 ACCIDENTS
Oct. 1971 524 p
(NTSB-BA-71-3-Issue-2) Avail: NTIS HC $6.00/MF $0.95

Selected aircraft accident reports, in brief format, which occurred in United States civil aviation operations during calendar year 1970 are presented. The accidents were randomly selected and consist of 896 general aviation and 17 air carrier reports. The format presents the facts, conditions, circumstances, and probable cause for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors.
Author

N72-20022# Aeronautical Research Inst. of Sweden, Stockholm.
LIFTING-LINE THEORY FOR A ROTOR IN VERTICAL CLIMB
B. C. A. Johansson 1971 120 p refs Sponsored partly by Swed. Board for Tech. Develop.
(FFA-118) Avail: NTIS; Almqvist and Wiksell, Stockholm: Sw.Kr. 50

The problem of a helicopter rotor in vertical climb, hovering or slow descent (or a lightly loaded propeller in forward flight or operating statically) is treated with the method of matched asymptotic expansions. The fluid is assumed to be compressible, and the maximum velocities occurring are assumed to be subsonic. Two perturbation parameters are used: one, denoted by epsilon, is the ratio of a typical blade chord to the rotor diameter; the other, denoted by delta, is the ratio of the climb (or flight) velocity to the tip velocity of the rotor (or propeller). If the climb (or flight) velocity is small, zero or negative, delta is instead defined as the ratio of the sum of the climb velocity and the mean value of the normal induced downwash velocity through the rotor to the tip velocity. Besides epsilon and delta, also the ratio epsilon/delta is assumed to be small. Series solutions in epsilon and delta are obtained in the form of a two-term expansion in epsilon, where the first term is exact in delta, while the second term is a two-term expansion in delta. The solutions break down for delta = 0. As a numerical example, a two-blade rotor with constant blade chord and geometrical angle of attack is considered. The ratio of the tip speed of the rotor to the speed of sound is 1/square root of 2.
Author (ESRO)

N72-20023# Aeronautical Research Inst. of Sweden, Stockholm.
TROPOSPHERIC AND TURBULENT CONTRIBUTIONS TO SONIC BOOMS
Robert F. Dressler 1970 31 p refs
(FFA-121) Avail: NTIS; Almqvist and Wiksell, Stockholm: Sw.Kr. 25

A proof is presented, based upon an analysis of experimental measurements, that the large-scale tropospheric winds produce a significant portion, relative to the contribution from ground-layer turbulence, of the total sonic-boom magnification. The analysis uses Oklahoma City A-flight measurements, resolving them into contributions from ground-layer effects and from large-scale tropospheric effects. It is shown that ground-layer intensity varied over a 7 to 1 range during the 92 test days, demonstrating how critically the interpretation of any test must depend upon

full knowledge of turbulence intensity during each test day. Since the statistical method produces first a biased estimate, analysis-of-variance is employed for an unbiased comparison. The result for 30,000 ft. mean altitude shows that the standard deviation of the tropospheric log M-distribution is 40% as large as sigma of the ground-layer distribution. If the assumed linear extrapolation of sigma to SST altitudes is reasonable, this indicates that tropospheric contribution would increase to become equal to ground-layer effect at SST altitudes, implying that double magnifications would occur four times more often with SST's than in the 30,000 ft. Oklahoma tests. Author (ESRO)

N72-20024# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugversuchstechnik.

[A METHOD OF EXPERIMENTAL DETERMINATION OF MAXIMUM CLOTH STRETCHING IN PARACHUTE CANOPIES]

Werner Raspe 1971 24 p refs In GERMAN; ENGLISH summary

(DLR-MITT-71-17) Avail: NTIS; DFVLR Porz: 8 DM

In order to determine the stretch of parachute fabrics during deployment, a simple elongation meter is developed and tested during parachute descents. The meter consists of a synthetic fiber which actuates a needle on elongation, and is accurate to 1 mm. Fabric stretch tests are reported. ESRO

N72-20025# National Aerospace Lab., Amsterdam (Netherlands). Div. of Flight Dynamics.

ON THE USE OF PANEL METHODS FOR PREDICTING SUBSONIC FLOW ABOUT AEROFOILS AND AIRCRAFT CONFIGURATIONS

W. Loeve and J. W. Slooff 6 Oct. 1971 22 p refs Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971

(NLR-MP-71018-U) Avail: NTIS

The possibility for accurate prediction of aerodynamic characteristics had been widely increased by the development of panel methods. These are based on the construction of numerical solutions of the Laplace equation by means of discretized surface distributions of source, doublet and vortex singularities. The flexibility of such methods, especially those for subsonic flow, enables the application to a wide variety of flow problems ranging from simple two-dimensional airfoils to complicated aerodynamic interference problems. By introduction of appropriate, semi-empirical compressibility corrections it is further possible to obtain accurate results up to the critical Mach number. A developed subsonic panel method is applied to a number of flow problems including two-dimensional transonic airfoil design and three-dimensional interference effects on wing-pylon-store and wing-body-tail arrangements. Author (ESRO)

N72-20026# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).

ADAPTATION OF A NONLINEAR ATTITUDE REGULATOR DEVELOPED FOR A V/STOL AIRCRAFT, TO A HELICOPTER [ANPASSUNG EINES LAGEREGLERS NICHTLINEARER CHARAKTERISTIK, ENTWICKELT FUER EIN VSTOL-FLUGZEUG, AN EINEN HUBSCHRAUBER]

H. Schmidtlein Cologne DGLR Oct. 1971 72 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971

Avail: NTIS

The adaptation of a nonlinear attitude controller developed for the VAK 191B V/STOL aircraft and the flying test bed SD-1262, to a Bell 47-G helicopter, is described. It was found necessary to damp the rotor vibrations with a low pass filter. The optimal transient response of the helicopter-nonlinear regulator system was somewhat slower than the optimum reached with the test bed, due to the time response lag of the helicopter. The pilot maneuverability of the helicopter with nonlinear regulator was found to be good, especially at night and in bad weather. ESRO

N72-20027# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).

ANGLE OF ATTACK AND THRUST CONTROL OF STEEP APPROACH AIRCRAFT [ANSTELLWINKEL- UND SCHUBREGELUNG FUER STEILANFLIEGENDE FLUGZEUGE]

G. Schaenzer 1971 32 p refs In GERMAN Presented at the 4th DGLR Annual Meeting Baden-Baden, West Ger., 11-13 Oct. 1971

Avail: NTIS

An integrated STOL approach control system is proposed, which reduces angle of attack and altitude control as well as all essential position variables, to aerial rudder and thrust control, and improves approach preciseness, passenger comfort, and noise problems. The design of the system was carried out using modern optimization methods, and has been flight tested. More than 200 automatic landings, including non-rectilinear steep approaches with path angles up to 9 deg have been performed, and these are reported on. ESRO

N72-20028# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

BUILT-IN TEST EQUIPMENT Final Report

1 Nov. 1971 18 p refs

(AMCR Proj. 310-6)

(AD-734853; MTP-7-3-058) Avail: NTIS CSCL 01/3

The report describes a method for evaluation of aircraft built-in test equipment performance characteristics. It provides procedures for inspection, physical characteristics, electrical power requirements, compatibility with related equipment, operational performance, electromagnetic interference, durability, maintenance evaluation, maintainability, reliability, achieved availability, safety, human factors, and personnel training requirements. Author (GRA)

N72-20029# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

ANALYSIS OF AIRCRAFT EXHAUST EMISSION MEASUREMENTS: STATISTICS

H. T. McAdams 19 Nov. 1971 182 p

(Contract EPA-68-04-0040)

(PB-204869; CAL-NA-5007-K-2; APTD-0848) Avail: NTIS CSCL 21B

The purpose is to isolate the causes or sources of both fixed and random contributions to the variability observed in the data and to estimate, wherever possible, the magnitudes of these contributions. Specific questions of broad interest are addressed, and statistical inferences drawn with respect to these questions. Author

N72-20030# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

ANALYSIS OF AIRCRAFT EXHAUST EMISSION MEASUREMENTS Technical Report, Jun. - Sep. 1971

Leonard Bogdan and H. T. McAdams 15 Oct. 1971 643 p

(Contract EPA-68-04-0040)

(PB-204879; CAL-NA-5007-K-1; APTD-0851) Avail: NTIS CSCL 13B

Pollutant mass emissions for carbon monoxide (CO), hydrocarbons (HC), and the oxides of nitrogen (NO (x)) are computed for an aircraft operational cycle comprised of the following modes: taxi/idle, take-off, climb out, and approach. The calculations are for specific engine power (or thrust) settings for each mode, as well as for specified times in mode. Numerical results are tabulated for each individual engine tested, together with summaries obtained by aggregating engine data on a model basis. Data are presented for turboprop/turbine engines, light-utility piston engines, and auxiliary power units.

Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-20031* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTIMUM PERFORMANCE SPACECRAFT SOLAR CELL SYSTEM Patent
Edward M. Gaddy, inventor (to NASA) Issued 18 Jan. 1972 12 p Filed 18 Nov. 1970 Supersedes N71-28413 (09 - 16, p 2537)
(NASA-Case-GSC-10669-1; US-Patent-3,636,539; US-Patent-Appl-SN-90595; US-Patent-Class-340-210; US-Patent-Class-244-155; US-Patent-Class-136-89) Avail: US Patent Office CSCL 10A

A solar cell system is described with a switching circuit to provide compensation from environmental changes. Relay operated switches change the solar cells from a first series-parallel interconnection to a second series-parallel interconnection. The relays are actuated by a command device which may be a telemetry receiver. A protection circuit comprising a photodiode is connected between the command device and the relays to ensure appropriate solar cell orientation when switching occurs. This prevents arcing across the relay switches.
Official Gazette of the U.S. Patent Office

N72-20032* ESB, Inc., Yardley, Pa.
ELECTRIC STORAGE BATTERY Patent
Thomas H. Purcell, Jr. and Alfred W. Jordan, inventors (to NASA) Issued 7 Dec. 1971 32 p Filed 26 Nov. 1969 Supersedes N70-34686 (08 - 18, p 3287) Sponsored by NASA
(NASA-Case-NPO-11021; US-Patent-3,625,766; US-Patent-Appl-SN-880250; US-Patent-Class-136-79; US-Patent-Class-136-81; US-Patent-Class-136-166) Avail: US Patent Office CSCL 10C

An electric storage battery is described that is particularly suited for resisting forces experienced in an impact environment. It is characterized by a number of flexible, narrow battery plates, of opposite polarities, suspended within a sealed housing having a pair of parallel internal surfaces with numerous grooves. The grooves support the plates of one polarity along opposed vertical surfaces, while the plates of the other polarity are suspended in a manner such that the plates of the first polarity serve to impart lateral support to the plates of both polarities in an impact environment. Official Gazette of the U.S. Patent Office

N72-20033* Boeing Co., Seattle, Wash.
SOLAR CELL ASSEMBLY TEST METHOD Patent
Charles W. Cable, inventor (to NASA) Issued 28 Dec. 1971 16 p Filed 27 Feb. 1970 Supersedes N70-34560 (08 - 18, p 3287) Sponsored by NASA
(NASA-Case-NPO-10401; US-Patent-3,630,627; US-Patent-Appl-SN-15025; US-Patent-Class-356-222; US-Patent-Class-210-212) Avail: US Patent Office CSCL 10A

The apparatus and technique are described for identifying faulty cells or connections between cells in solar cell assemblies. The defects are located by measuring power generation from the assembly as selected cells are subjected to differential illumination either by shadowing the cell or by applying local higher intensity illumination to the cell. Official Gazette of the U.S. Patent Office

N72-20034* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING emf CELL Patent
Jacob Greenberg, inventor (to NASA) Issued 18 Jan. 1972 4 p Filed 5 Jun. 1970 Continuation-in-part of US Patent Appl. SN-787911, filed 30 Dec. 1968
(NASA-Case-LEW-11359-2; US-Patent-3,635,765; US-Patent-Appl-SN-57399; US-Patent-Class-136-83R; US-Patent-Class-136-100R; US-Patent-Class-136-175) Avail: US Patent Office CSCL 10A

A heat-activated electromotive force cell having an anode formed of aluminum and a cathode comprising an oxidizing material such as sulfur is described. The cathode material is supported in a container or in a matrix such as porous carbon. An aluminum salt layer electrolyte such as AlCl separates the anode from the cathode. To minimize vaporization of the aluminum salt, an alkali halide salt may be mixed therewith. The cell may be operated at temperatures up to a point where either the cathode material or the electrolyte is molten.
Official Gazette of the U.S. Patent Office

N72-20035*# Gould, Inc., Mendota Heights, Minn. Energy Technology.
IMPROVED PLAQUE MATERIALS FOR AEROSPACE NICKEL-CADMIUM CELLS Final Report, 17 Nov. 1969 - 31 May 1971
E. Luksha and D. J. Gordy Jun. 1971 84 p refs
(Contract NAS5-21097)
(NASA-CR-122371; Rept-712-091) Avail: NTIS CSCL 10C

Improved cadmium electrode substrates with precisely controlled microstructures for possible use in aerospace nickel-cadmium cells were prepared. The preparative technique was a powder metallurgical process in which a fugitive pore-former and a nickel powder were blended, then isostatically compacted, and subsequently sintered. Cadmium electrodes prepared from such substrates were cycle tested using an accelerated tortuous test regime. It was discovered that plaques of 60% or 80% porosity prepared with a 25 micron pore-former were better than state-of-the-art electrodes in terms of efficienty and/or mechanical strength. The 60% structures were particularly outstanding in this respect in that they had efficiencies only 5-10 percentage points lower than state-of-the-art electrodes and vastly superior mechanical properties. This added strength was observed to eliminate cracking and physical degradation of the electrodes during processing and cycling. The cadmium electrodes prepared from the 80% porous substrates proved to be the best electrodes made during the course of the work from the point of view of highest efficiency. Three-point bend tests were used to measure mechanical properties of the plaques produced and also as a general characterization tool. In addition, the BET surface areas of selected specimens was determined. The SEM was used for judging microscopic uniformity and quantitatively determining the induced pore size and various other fine structures in the substrates. The technique of X-ray radiography was used to follow the bulk uniformity of the substrates at various stages of their processing. Author

N72-20036*# AiResearch Mfg. Co., Phoenix, Ariz.
DESIGN AND FABRICATION OF THE BRAYTON ROTATING UNIT
J. E. Davis Washington NASA Mar. 1972 390 p refs
(Contract NAS3-9427)
(NASA-CR-1870; APS-5334-R) Avail: NTIS HC $6.00/MF $0.95 CSCL 10A

The Brayton rotating unit (BRU), operating on a gas bearing system, has been designed, fabricated, and demonstrated for use in a closed Brayton cycle space power conversion system. The BRU uses a binary mixture of xenon and helium (molecular weight, 83.8) as the cycle working fluid and bearing lubricating medium and was designed to produce from 2.25 to 10.5 kw sub e of 1200 Hz three-phase electrical power. The single-shaft rotating assembly operates at a design speed of 36,000 rpm and comprises a radial single-stage compressor, a four-pole Rice alternator rotor, and a radial inflow turbine. Four units, a dynamic simulator and three component research packages, were supplied to the NASA Lewis Research Center for performance testing and further development. Author

N72-20037*# National Aeronautics and Space Administration, Washington, D.C.
METHOD AND MEANS FOR CHARGING A STORAGE BATTERY Patent Application
Ernst M. Cohn, inventor (to NASA) Filed 10 Dec. 1971 13 p
(NASA-Case-HQN-10697; US-Patent-Appl-SN-206663) Avail: NTIS CSCL 10C

A method is described for separately charging sections of a battery at a high rate from a source of limited power. This is accomplished by a switching arrangement with which each section of the battery is separately connectable across the source so that each section is charged at a high rate. By separately and successively charging the sections, rather than the entire battery, the rate at which each section is charged is significantly higher than the rate at which the entire battery is chargeable when connected at once across the same source of limited power. NASA

N72-20038*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STACKED SOLAR CELL ARRAYS Patent Application
Jerome M. Weingart and Robert K. Yasui, inventors (to NASA) Filed 22 Nov. 1971 14 p
(Contract NAS7-100)
(NASA-Case-NPO-11771; US-Patent-Appl-SN-200762) Avail: NTIS CSCL 10A

A solar cell stack, for use in a spacecraft or the like, is disclosed. In the stack only the top solar cell panel is exposed to solar energy to provide electrical power. Except for the top panel, each panel is covered from exposure to damaging bombarding particles by the preceding panels in the stack. When the exposed top panel's performance is degraded, due to bombardment by particles or other unexpected failure, the top panel is ejected, thereby exposing the underlying panel in the stack, which now becomes the power supplying panels. Each panel in the stack is successively exposed when the panel above it is ejected. NASA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-20039*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF SPACE BIOLOGY. VOLUME 9: OUTLINE OF SPACE RADIOBIOLOGY
P. P. Saksonov, V. V. Antipov, and B. I. Davydov Washington NASA Feb. 1972 616 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii, tom 9, Ocherki Kosmicheskoy Radiobiologii" Moscow, Nauka Press, 1968 p 1-603
(Contract NASw-1695)
(NASA-TT-F-604) Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

The effects of space radiation on a broad spectrum of biological entities is dealt with. Generalized data concerning the combined effect of radiation with other factors of flight, obtained in model experiments and under the conditions of space flight, are given. For individual titles, see N72-20040 through N72-20047.

N72-20040*# Techtran Corp., Glen Burnie, Md.
THE RADIATION SITUATION IN SPACE
In its Probl. of Space Biol., vol. 9 Feb. 1972 p 1-34 ref (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

A comprehensive analysis of ionizing radiation sources in space is presented. Data obtained by both U.S.S.R. and U.S. satellites are used as a basis for conclusions regarding the role, importance, and place of radiation hazards in manned space flight. The radiation sources dealt with are divided into two groups: The first group includes natural sources of ionizing radiation in space; primary cosmic rays, charged particles of the near-earth radiation belts, and corpuscular radiation generated by solar flares. The second group includes artificial sources of radiation; radiation belts caused by nuclear explosions at high altitudes, and the use of nuclear power plants in spacecraft.
D.L.G.

N72-20041*# Techtran Corp., Glen Burnie, Md.
EVALUATION OF THE BIOLOGICAL EFFECT OF RADIATION AS APPLIED TO THE PROBLEMS OF SPACE RADIOBIOLOGY
In its Probl. of Space Biol., vol. 9 Feb. 1972 p 35-138 (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

Early somatic effects and later somatic illnesses (for longer flights) are of primary importance to space radiobiology. Radiation sickness symptoms are described with particular emphasis on hematological and neurologic effects. Animal experiments and human experience are included. Author

N72-20042*# Techtran Corp., Glen Burnie, Md.
EFFECT OF FLIGHT FACTORS ON RADIOBIOLOGICAL EFFECTS
In its Probl. of Space Biol., vol. 9 Feb. 1972 p 139-209 (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

The effects of such flight factors as temperature, gas medium, accleration, vibration, weightlessness, physical loads and microwave irradiation on the action of ionizing radiation on the organism are reviewed. Data are basically taken from animal experiments with mice and dogs. Author

N72-20043*# Techtran Corp., Glen Burnie, Md.
CHARACTERISTICS OF THE BIOLOGICAL EFFECT OF COSMIC RADIATION
In its Probl. of Space Biol., vol. 9 Feb. 1972 p 210-252 (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

The relative biological effectiveness of various types of particle and wave radiation is noted. Experiments on mice, rats and dogs are reviewed. Author

N72-20044*# Techtran Corp., Glen Burnie, Md.
SPACE PHARMACOLOGY
In its Probl. of Space Biol., vol. 9 Feb. 1972 p 253-417 refs (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06E

The problems and techniques of space pharmacology are described. Three problems are specifically discussed: (1) chemical protection from radiation damage, (2) reactivity of organisms to medical agents and the aftereffects of certain spaceflight factors, and (3) the principles of selection of drugs intended for the crews of spacecraft. Author

N72-20045*# Techtran Corp., Glen Burnie, Md.
CRITERIA FOR DETERMINING THE PERMISSIBLE DOSES OF IRRADIATION FOR ASTRONAUTS
In its Probl. of Space Biol., vol. 9 Feb. 1972 p 418-470 ref (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

Certain problems in determining the permissible doses of ionizing radiation for astronauts are assessed. Reactions of the human organism to radiation are tabulated and discussed.
Author

N72-20046*# Techtran Corp., Glen Burnie, Md.
STUDY OF THE BIOLOGICAL EFFECT OF COSMIC RADIATION IN FLIGHT EXPERIMENTS

In its Probl. of Space Biol., vol. 9 Feb. 1972 p 471-547 (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

Studies on the biological effect of radiation carried out under flight conditions are described. Equipment and results are tabulated from flight experiments made over the last 40 years.
Author

N72-20047*# Techtran Corp., Glen Burnie, Md.
PROTECTION OF VOSTOK AND VOSKHOD COSMONAUTS FROM THE RADIATION HAZARDS
In its Probl. of Space Biol., vol. 9 Feb. 1972 p 548-603 refs (See N72-20039 11-04)
Avail: NTIS HC $9.00/MF $0.95 CSCL 06R

The protective systems used in the Vostok and Voskhod spacecraft are described. They provided: physical shielding, dosimetry, biological dosimetry, medical hygienic measures, and radiation level forecasting.
Author

N72-20048*# National Aeronautics and Space Administration, Washington, D.C.
THE EXPERIMENTS OF BIOSATELLITE 2
Joseph F. Saunders, ed. 1971 358 p refs Original contains color illustrations
(NASA-SP-204; LC-78-609943) Avail: NTIS; SOD $3.50 CSCL 06C

Experiments are described with invertebrates, plants, and cellular systems which were included on the flight of Biosatellite 2. The results of flight and ground control experiments are discussed. For individual titles, see N72-20049 through N72-20066.

N72-20049*# National Aeronautics and Space Administration, Washington, D.C.
BIOSATELLITE 2: THE NATION'S FIRST BIOLOGY LABORATORY IN SPACE **c31**
Joseph F. Saunders, Orr E. Reynolds, and G. Dale Smith (Calif. Univ., Berkeley) *In its* The Expt. of Biosatellite 2 1971 p 1-14 refs (See N72-20048 11-04)
Avail: NTIS; SOD $3.50 CSCL 22B

Biosatellite 2, a biological space laboratory, is described. Experiment selection and accommodation are discussed. Thirteen experiments were flown in order to study the effects on life processes of weightlessness and of weightlessness combined with gamma radiation. The basic goal of the flight was to determine the effects of the space environment on fundamental biochemical processes in cells, the development and growth of plants and animals, the structure of living tissues, and changes, if any, in genetic transmissibility. The experiment results indicated an interaction between radiation and one or more factors encountered during space flight. Postflight laboratory control studies were conducted to clarify ambiguities and to interpret more precisely the phenomena observed in the preliminary results.
K.P.D.

N72-20050*# Oak Ridge National Lab., Tenn.
MUTATIONAL AND PHYSIOLOGIC RESPONSES OF HABROBRACON IN BIOSATELLITE 2
R. C. vonBorstel, R. H. Smith, Anna R. Whiting, and D. S. Grosch (North Carolina State Univ.) *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 17-39 refs Sponsored in part by AEC (See N72-20048 11-04)
(Grant NGR-34-002-023)
(Expt-P-1079) Avail: NTIS; SOD $3.50 CSCL 06C

Results of three experiments involving the parasitic wasp, Habrobracon, are reported, one in orbital flight, and two in tests on the earth after the flight. Five packages, each containing four modules to hold the wasps, were used for the experiments. The modules were secured on each package to face the radiation source. Most Habrobracon were exposed to five different exposures of radiation during the flight. The various strains of Habrobracon selected for the experiment are discussed in relation to their properties. Genetic analyses of male and female Habrobracon are presented. Genetic recombination, mating behavior in males, and physiological and late effects were observed. Experiments were also conducted on the X841 strain of yeast and the San Francisco strain of Artemia salina. Bioassays were made of Saccharomyces for intragenic and intergenic recombination. Effects of vibration and weightlessness are also discussed.
K.P.D.

N72-20051*# Bowling Green State Univ., Ohio.
GENETIC IMPLICATIONS OF SPACEFLIGHT
Irwin I. Oster *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 41-54 refs (See N72-20048 11-04)
(Expt-P-1160) Avail: NTIS; SOD $3.50 CSCL 06C

Results of experiments using highly specialized strains of the fruit fly, Drosophila melanogaster, are presented. The types of effects on somatic and reproductive cells are tabulated. The results reported suggest that radiation appears to interact with weightlessness to produce a higher mortality, more chromosomal breakage followed by loss or exchange of genetic information, and more sex-linked recessive lethal mutations in actively growing and metabolizing individuals than are produced in those irradiated on earth.
K.P.D.

N72-20052*# Rice Univ., Houston, Tex.
GENETIC EFFECTS OF THE SPACE ENVIRONMENT ON THE REPRODUCTIVE CELLS OF DROSOPHILA ADULTS AND PUPAE
Luolin S. Browning *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 55-78 refs Prepared in cooperation with St. Thomas Univ. Original contains color illustrations (See N72-20048 11-04)
(Expt-p-1159) Avail: NTIS; SOD $3.50 CSCL 06C

An account is presented of some of the experimental findings resulting from the study of possible transmissible genetic damage in the fruit fly, Drosophila melanogaster, caused by exposure to the conditions of space flight. Results are reported on mutations occurring in mature sperm in inseminated females, and teratogenic and genetic effects produced in cells in various stages of maturation.
K.P.D.

N72-20053*# California Univ., Berkeley.
SOME EFFECTS OF SPACEFLIGHT ON THE FLOUR BEETLE, TRIBOLIUM CONFUSUM
Brenda Buchhold, J. V. Slater, I. L. Silver, T. Yang, and C. A. Tobias *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 79-95 refs (See N72-20048 11-04)
(Expt-P-1039) Avail: NTIS; SOD $3.50 CSCL 06C

Stock cultures of Tribolium confusum Duval pupae were grown at 30 C in whole wheat flour with 2% yeast additive. Age sensitivity studies involving larval and pupal sensitivity to radiation were made. Postflight tests for wing abnormality and genetic mutations were made several months after the Biosatellite 2 flight. The results also indicate that there is internal compensation in animal development for changes in the gravitational field.
K.P.D.

N72-20054*# Brookhaven National Lab., Upton, N.Y.
RADIOBIOLOGIC STUDIES OF TRADESCANTIA PLANTS ORBITED IN BIOSATELLITE 2
Arnold H. Sparrow, Lloyd A. Schairer, and Kodumudi M. Marimuthu *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 99-122 refs (See N72-20048 11-04)
(Expt-P-1123) Avail: NTIS; SOD $3.50 CSCL 06R

The Biosatellite 2 Tradescantia experiment was designed to determine the effect of weightlessness and other spacecraft environmental conditions on spontaneous and radiation-induced somatic mutation rates and on selected cytologic changes. Data obtained from irradiated and nonirradiated plants flown in Biosatellite 2 were compared with data from nonflight irradiated and nonirradiated plants maintained under conditions similar to those of the flight material. Thirty-two flight control plants were

flown in a package in the spacecraft behind the radiation shield, and identical nonflight control packges (with and without irradiation) were maintained at the launch site. All these plants were observed after the flight for (1) somatic mutation (blue to pink or colorless cells; (2) cell size (giant and dwarf condition; (3) loss of reproductive integrity (cell death and stunting in stamen hair growth); (4) pollen grain mortality (early and late stages); (5) megaspore development; (6) abnormal cell divisions; and (7) chromosome aberrations. K.P.D.

N72-20055*# Emory Univ., Atlanta, Ga.
THE EFFECT OF WEIGHTLESSNESS ON THE GROWTH AND ORIENTATION OF ROOTS AND SHOOTS OF MONOCOTYLEDONOUS SEEDLINGS
Stephen W. Gray and Betty F. Edwards *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 123-165 refs (See N72-20048 11-04)
(Expt-P-1020) Avail: NTIS; SOD $3.50 CSCL 06C

Wheat seedlings were used in the experiment because of their convenient size, rapid and consistent germination, and measurable geotropic response. Selection, sterilization, and soaking the seeds; planting procedures; methods of fixation and measurement of seedlings; earth controls and baseline testing; and germination and survival are discussed. Also considered are changes in gross morphology; seedling growth; seedling response to vibration and/or flight; histology and histochemistry; and cytology. Results are presented for studies of mortality, coleoptiles, root growth, malformations, starch grains, statoliths, metabolic rate, cell division and elongation, and nuclear size. K.P.D.

N72-20056*# Dartmouth Coll., Hanover, N.H.
GROWTH PHYSIOLOGY OF THE WHEAT SEEDLING IN SPACE
Charles J. Lyon *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 167-188 refs (See N72-20048 11-04)
(Expt-P-1096) Avail: NTIS; SOD $3.50 CSCL 06C

The growing of wheat seedlings in Biosatellite 2 was an experiment designed to determine whether seeds would produce normal seedlings when they germinated in the absence of significant gravitational force. A culture method developed for germination of wheat seeds, with the seedlings suspended in sealed moist chambers, was successful in producing young plants with organ orientation like that of seedlings rooted in soil. The stresses of launch acceleration and vibration had no measurable effects on germinated wheat seeds, as determined by the physiology of their subsequent germination and seedling growth during an orbital flight of about 45 hours. Growth physiology of wheat seed germination and the development of wheat seedlings in their early stages were not disturbed enough by the absence of gravity to be reflected in growth rates or external morphology of roots and coleoptiles. Author

N72-20057*# RPC Corp., El Segundo, Calif.
A STUDY OF THE EFFECT OF WEIGHTLESSNESS ON THE BIOCHEMICAL RESPONSE OF A MONOCOTYLEDONOUS SEEDLING
Herbert M. Conrad *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 189-212 refs (See N72-20048 11-04)
(Expt-P-1138) Avail: NTIS; SOD $3.50 CSCL 06C

The experimental program was designed to: (1) relate the anticipated response to metabolic and energetic reactions throughout the length of roots and shoots; (2) determine whether changes in metabolism which occur on the clinostat would also be found in space-grown seedlings; and (3) compare the biochemistry of epinastic curvature with that of geotropic curvatures. The activity of key enzymes associated with some of the pathways of intermediary metabolism and energetics was measured. The enzymes were examined for structural integrity because of possible weakening of the tertiary forces which hold protein molecules together in a highly ordered manner. The results are described for biochemical analyses performed on space-grown seedlings, their corresponding earth controls, and postflight verification experiments. It is shown that growth of seedlings on the clinostat simulates growth in a weightless environment. Author

N72-20058*# North American Rockwell Corp., Downey, Calif.
BIOCHEMICAL CHANGES IN THE ENDOSPERM OF WHEAT SEEDLINGS IN THE WEIGHTLESS STATE
Samuel P. Johnson, J. A. Green, and D. K. Chapman *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 213-221 refs (See N72-20048 11-04)
(Expt-P-1138) Avail: NTIS; SOD $3.50 CSCL 06C

The biochemical analyses of wheat seedling endosperms exposed to 45 hours of weightlessness during the flight of Biosatellite 2 did not reveal any differences in the concentrations of carbohydrates, amino acids, and nitrogen fractions from those in control samples. Postflight tests designed to verify the results of the flight revealed differences in the concentrations of individual amino acids, but the pattern was irregular and not statistically significant. Author

N72-20059*# North American Rockwell Corp., Downey, Calif.
THE LIMINAL ANGLE OF A PLAGIOGEOTROPIC ORGAN UNDER WEIGHTLESSNESS
Samuel P. Johnson, T. W. Tibbitts (Wisconsin Univ.), J. A. Green, and D. K. Chapman *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 223-248 refs Original contains color illustrations (See N72-20048 11-04)
(Expt-P-1017) Avail: NTIS; SOD $3.50 CSCL 06C

The experiment was designed to evaluate alterations in the behavior of the pepper plant, Capsicum annuum, in response to a weightless environment. The effects of rotation on the horizontal clinostat to simulate weightlessness and an orbital flight time of 45 hours were evaluated on 25- and 35-day-old pepper plants. Plant species selection, plant characteristics, environmental factors, and growing procedures are discussed. The samples prepared for chemical analyses were composed of the following components from the four control and flight packages: (1) leaves from large or prime plants, (2) leaves from small or auxiliary plants, (3) stems from small plants, and (4) growing tips from small plants. Carbohydrate, amino acid, and nitrogen analyses were made. Several vibration tests were conducted to determine the effect of the flight launch vibration profile on Capsicum plants. The plants were also subjected to acoustic levels that simulated the launch and recovery flight environments in order to determine the effect on liminal angle plant response. Author

N72-20060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF WEIGHTLESSNESS ON THE DIVIDING EGGS OF RANA PIPIENS
Richard S. Young, John W. Tremor, Richard Willoughby, Robert L. Corbett, Kenneth A. Souza, and Paul D. Sebesta *In its* The Expt. of Biosatellite 2 1971 p 251-271 refs Original contains color illustrations (See N72-20048 11-04)
(Expt-P-1047) Avail: NTIS; SOD $3.50 CSCL 06C

The eggs of Rana pipiens, the grass or leopard frog, were chosen as the experiment material. The fertilized egg divided, differentiated, and developed normally in over two days of weightlessness in Biosatellite 2, despite initiation of exposure at the middle of the two-cell stage. Flight conditions may have effected a slight, transient abnormality that probably can occur under a variety of conditions. The significance of experimental variables is discussed. It is thought that earlier exposure of the egg to weightlessness, i.e. with and after fertilization, would complement the findings of earth-based studies in which gravity was implicated as a determiner of normal development. Author

N72-20061*# General Electric Co., Philadelphia, Pa.
NUCLEAR AND CELLULAR DIVISION IN PELOMYXA CAROLINENSIS DURING WEIGHTLESSNESS
Donald R. Ekberg, Elaine C. Silver, Judith L. Bushay, and Edward W. Daniels (ANL) *In* NASA, Washington The Expt. of

Biosatellite 2 1971 p 273-290 refs (See N72-20048 11-04)
(Expt-P-1035) Avail: NTIS; SOD $3.50 CSCL 06C

In order to study the effects of weightlessness on a single cell, the giant multinucleate amoeba Pelomyxa carolinensis was chosen. Results of temperature measurement, plasmotomy rates, and clinostat studies are presented. No significant differences were found in division rates between the flight and earth control groups. There appeared to be a trend toward a higher division rate in well-fed Polymyxae during weightlessness. Nuclear division during weightlessness was synchronous. No difference was apparent in postflight cell division rates of flight and earth control groups. Flight vibration and acceleration had no observable effect upon the growth rate of amoebae. K.P.D.

N72-20062*# Colorado State Univ., Fort Collins.
EFFECTS OF WEIGHTLESSNESS ON THE NUTRITION AND GROWTH OF PELOMYXA CAROLINENSIS
John H. Abel, Jr., David W. Haack, and Richard W. Price *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 291-308 refs (See N72-20048 11-04)
(Expt-P-1035) Avail: NTIS; SOD $3.50 CSCL 06C

A study was made in an attempt to answer the question: Can animal cells which are preformed and viable grow and divide in the absence or near absence of a gravitational field? The effects of the space environment, acceleration, and vibration on feeding, growth, and morphology were studied in amoebae, Pelomyxa carolinensis, that were starved for periods of 27 to 75 hours or were continuously fed. Results are presented for studies of gross morphology, effects of weightlessness on survival and growth, and cytology. The rate of digestion of ingested paramecia, Paramecium micronucleatum, was determined from the percentage distribution of various ages of food vacuoles (new to old). It was concluded that neither rate, nor normal processes, of digestion was changed as a result of the Biosatellite 2 flight or simulated flight conditions. K.P.D.

N72-20063*# California Univ., Berkeley.
INDUCTION OF LYSOGENIC BACTERIA IN THE SPACE ENVIRONMENT
R. H. T. Mattoni (NUS Corp.), E. C. Keller, Jr. (NUS Corp.), W. T. Ebersold, F. A. Eiserling, and W. R. Romig *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 309-324 refs (See N72-20048 11-04)
(Expt-P-1135) Avail: NTIS; SOD $3.50 CSCL 06C

The Biosatellite 2 experiment using the lysogenic bacterium Salmonella typhimurium was designed to test the hypotheses that weightlessness, both with and without gamma irradiation, would affect bacterial cell growth or induction of bacterial prophage. The bacterial data were analyzed by three methods: analysis of variance, t tests between flight and earth control data (where t is the percentage difference between experiment and control sets), and graphic presentation. The data on bacterial growth led to rejection of the hypotheses; space flight produced both increased density of Salmonella typhimurium when grown in liquid medium and interaction to give greater resistance to gamma irradiation at levels between 265 and 1648 R total dose (17 and 103 R per average cell generation). Tests of other variables eliminated all but weightlessness in accounting for the difference. On the basis of the t tests there was no difference in the free phage per bacterium produced under conditions of control and those of flight. The induced bacteriophage per viable bacterium showed significant differences between flight and control at two radiation levels (265 and 645 R). The flight set had consistently lower yields at all levels of radiation. K.P.D

N72-20064*# Oak Ridge National Lab., Tenn.
MUTAGENIC EFFECTIVENESS OF KNOWN DOSES OF RADIATION IN COMBINATION WITH ZERO GRAVITY ON NEUROSPORA CRASSA
Frederick J. DeSerres *In* NASA, Washington The Expt. of Biosatellite 2 1971 p 325-331 refs (See N72-20048 11-04)
(Expt-P-1037) Avail: NTIS; SOD $3.50 CSCL 06C

A study was made of the genetic effects on Neurospora crassa of space flight alone and of space flight in combination with known doses of radiation. A Sr-85 gamma ray source was used with a genetically marked, two-component heterokaryon, heterozygous for two different genes that control sequential steps in purine biosynthesis. An experiment was also performed to study the effects of anoxia on radiation-induced inactivation and induction of mutations. There was no difference between flight and earth control survival curves, nor between curves for the overall induction of ad-3 mutations. Data indicate that there is no difference between flight and earth control curves for either point mutations or chromosome deletions. K.P.D.

N72-20065*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RADIATION EXPOSURES DURING THE BIOSATELLITE 2 FLIGHT
John E. Hewitt *In its* The Expt. of Biosatellite 2 1971 p 333-346 refs (See N72-20048 11-04)
Avail: NTIS; SOD $3.50 CSCL 06C

Seven of the experiments flown on Biosatellite 2 were designed to determine the combined effects of radiation and weightlessness on mortality and mutagenesis in a variety of living systems exposed to an onboard source of radiation. Several months after the flight, a series of ground tests was initiated to determine whether the observed effects of interaction were due to vibration and acceleration associated with the flight, rather than to weightlessness. The results of dosimetry measurements indicate that it is unlikely that any difference found to occur between the biologic response of the same experiment in the flight and earth control capsules can be attributed to radiation exposure differences. No unusual results are due to the presence in the capsules of a large component of low energy radiation produced by multiple scattering. K.P.D.

N72-20066*# National Aeronautics and Space Administration, Washington, D.C.
THE SCIENTIFIC CONCLUSIONS OF BIOSATELLITE 2
Orr E. Reynolds and Joseph F. Saunders *In its* The Expt. of Biosatellite 2 1971 p 347-352 ref (See N72-20048 11-04)
Avail: NTIS; SOD $3.50 CSCL 06C

The experiments of Biosatellite 2 were designed to obtain information related to: (1) the ability of a spectrum of living systems to maintain normal organization and function during exposure to a space environment; (2) the biological effects imposed on gravity-dependent life processes by the absence of gravity and rotational periodicity; and (3) how weightlessness and quantified gamma radiation affect biologic processes during space flight. Observations were made on more than 100 end points at the molecular, cellular, and system levels of biological structure and physiological function. Author

N72-20067# RAND Corp., Santa Monica, Calif.
THE BIMOD SYSTEM IMPLEMENTATION
R. L. Clark and G. F. Groner Jul. 1971 38 p refs
(Grant GM-15896)
(R-747-NIH) Avail: NTIS

The system employs an interactive graphics console comprising a cathode ray tube (CRT), a data tablet, and a keyboard. A high level of man-machine interaction is provided. The user may communicate with the system by using the data tablet to draw block diagrams, handprint text, and activate program functions, and also by typing with the keyboard. BIOMOD interprets user actions and provides immediate feedback on the CRT. The BIOMOD system features hierarchical model structuring and user-oriented model-definition languages. The user may represent a model by a block diagram, each component of which may be defined in more detail by another block diagram. The user ultimately defines model components by analog-computer-like primitive functions, algebraic, differential or chemical equations, or FORTRAN statements. This obviates the requirement that he translate his model description into a conventional simulation language. During model simulation, displayed curves are automatically and continually updated; a

user may stop the simulation and then display curves for different variables, change scales, or alter simulation parameters. Author

N72-20068# RAND Corp., Santa Monica, Calif.
INTERACTIVE BIOCHEMICAL MODELING AND ANALYSIS
DeLand E. C. Sep. 1971 11 p refs Presented at 70th Natl. Meeting, Am. Inst. of Chem. Engr., Atlantic City, 29 Aug. - 1 Sep. 1971
(P-4704) Avail: NTIS

A description is given of BIOMOD, a user oriented computer graphic system which allows both equilibrium and kinetic computations in the same program. It also allows the user to write differential equations and FORTRAN programs as required for the simulation of his biochemical or physiological problem. The system may also be used for non-chemical problems. E.H.W.

N72-20069# Council for Scientific and Industrial Research, Pretoria (South Africa).
A STUDY OF THE TRANSIENT STAGE OF SWEATING IN MAN
J. Timbal, J. Colin, and C. Boutelier Nov. 1970 12 p refs Transl. into ENGLISH from Arch. Ges. Physiol. (West Berlin), v. 318 1970 p 305-314
(Rept-877) Avail: NTIS

The quantitative relationship between a body temperature level or levels and the flow of sweat is investigated. The experiments were carried out on nude subjects at complete rest. They were subjected to shock temperatures for 90 minutes, then allowed 90 minutes rest at neutral temperatures. Results show sweat initiation varied between subjects as did the steady flow. It was determined that sweat flow is influenced by individual body heat storage and individual reaction to heat loads. No definite quantitative relationships were established due to inconclusive data on neurohormonal and psychological effects. E.H.W.

N72-20070*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
APPLICATION OF VARIOUS ELASTIC THIN SHELL THEORIES TO BLOOD FLOW PROBLEMS
3 Apr. 1972 33 p refs Backup document for AIAA Synoptic, "Review and Application of Prestressed Shell Theories to Blood Vessel Wave Propagation", scheduled for publication in AIAA Journal in Aug. 1972
(Grant NGL-05-020-223)
(NASA-CR-125827) Avail: NTIS CSCL 06P

Some existing theories, on elastic thin shells, are reviewed to ascertain their influence on the computation of phase velocities in fluid filled cylinders representing certain aspects of the behavior of arteries and veins in vivo. For physiologically meaningful parameters, including moderately large in plane prestrain that occurs in mammals, the results suggest that with one exception, the small differences in the formulations exercise little influence on the phase velocities. However, it is demonstrated that inclusion of the forces induced by the rotation of the hydrostatic pressure is essential or significantly erroneous torsional wave speeds result. Also the introduction of moderate implane prestrains that are present in living mammals is shown to lead to nonselfadjoint differential equations of motion, whose biorthogonal eigenvectors differ slightly from each other. Author

N72-20071*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF NOISE ON THE PERFORMANCE OF A MEMORY DECISION RESPONSE TASK
Ben William Lawton Washington Apr. 1972 18 p refs
(NASA-TN-D-6675; L-8101) Avail: NTIS CSCL 05E

An investigation has been made to determine the effects of noise on human performance. Fourteen subjects performed a memory-decision-response task in relative quiet and while listening to tape recorded noises. Analysis of the data obtained indicates that performance was degraded in the presence of noise. Significant increases in problem solution times were found for impulsive noise conditions as compared with times found for the no-noise condition. Performance accuracy was also degraded. Significantly more error responses occurred at higher noise levels; a direct or positive relation was found between error responses and noise level experienced by the subjects. Author

N72-20072# Royal Aircraft Establishment, Farnborough (England).
THE CONTROL OF BODY TEMPERATURE IN MUSCULAR WORK
Marius Nielsen Sep. 1971 36 p refs Transl. into ENGLISH from Skandinav. Archiv., v. 79, 1938 p 193-230
(RAE-Lib-Trans-1610; BR-28413) Avail: NTIS

Body temperature rose in proportion to work rate but was found constant at a given working intensity in a wide range of ambient climatic conditions. This was due to a changing balance between heat dissipation by conduction and convection and by evaporation of sweat. It is inferred that the rise in body temperature during muscular work is a controlled effect and not a failure of heat dissipation. Author

N72-20073# Royal Aircraft Establishment, Farnborough (England).
BIOTECHNOLOGY AND APPLIED PSYCHOLOGY
Rune B. Johansson Jun. 1971 22 p Transl. into ENGLISH from Swedish report FOA-2-C2360-12
(RAE-Lib-Trans-1597; FOA-2-C-2360-12; BR-28317) Avail: NTIS

The current state-of-the-art of biotechnology and applied psychology in connection with Sweden's national defense is reviewed. Problems involving man/machine interaction in the perception and transfer of information are listed together with the present status of technology and the prognosis for future trends in research relating to these problems. D.L.G.

N72-20074*# Techtran Corp., Glen Burnie, Md.
GASTRIC MOTILITY DURING REST AND PHYSICAL EXERCISE
K. Lagemann and K. Hoffmann Washington NASA Mar. 1972 11 p refs Transl. into ENGLISH from Fortschr. Gebiete Roentgenstrahlen Nuklearmed. (Stuttgart), v. 115, no. 6, 1971 p 817-821
(Contract NASw-2037)
(NASA-TT-F-14207) Avail: NTIS CSCL 06P

Gastric motility was studied in 90 normal people at rest and during a period of tachypnoea produced by physical exercise. Statistical analysis of the parameters obtained showed no effect of physical exercise on gastric motility. Author

N72-20075# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE DECOMPRESSION PROBLEM
S. Ruff 7 Oct. 1971 101 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-48) Avail: NTIS; DEVLR Porz-Wahn: 2990 DM

The bubble in the organism is recognized as the governing quantity for the construction of safe decompressions. On this basis and using the empirical material, a set of allowed gas tensions in the tissue is proposed. From this, decompression schedules for arbitrary dives in helium-nitrogen mixtures can be calculated. An expression for the bubble growth in the organism during a decompression is developed and applied to the discussion of the allowed gas tensions proposed here. In the appendix dives of the institute and the decompression schedules of the U.S. Diving Manual are analyzed. Author

N72-20076# Japan Atomic Energy Research Inst., Tokyo.
NEW METHOD OF DOSE EVALUATION BY SPECTRUM DOSE CONVERSION OPERATOR AND DETERMINATION OF THE OPERATOR
Shigeru Moriuchi 9 Oct. 1970 39 p refs In JAPANESE; ENGLISH summary
(JAERI-1209) Avail: AEC Depository Libraries

A new method of dose evaluation by the spectrum dose conversion operator is very simple, because radiation dose can be evaluated directly from the observed pulse-height spectrum by applying an operator to the spectrum itself. The details of this method are described concentrating on determination of the operational function G(E) from the point of view of exposure measurements with NaI(Tl) scintillators. Tables of numerical values of G(E) functions of NaI(Tl) scintillators of 1 in. phi x 1 in. to 6 in. phi x 6 in., which were calculated using an electronic computer, are also given. Author (NSA)

N72-20077# Instituut voor Toepassing van Atoomenergie in de Lanbouw, Wageningen (Netherlands).
APPLICATION OF ATOMIC ENERGY IN AGRICULTURE Annual Report, 1970
1971 92 p refs
(NP-19016) Avail: AEC Depository Libraries

Work carried out during 1970 at the Association's Institute in Wageningen and at other institutes in Belgium, Germany, Italy, and the Netherlands is reported under the following headings: mutation breeding, methodology; mutation breeding, collaboration; radiogenetics, ontogenetic factors, radiogenetics, physical and chemical factors; related genetic studies; related in vitro studies; preservation of food by means of radiation; induction of male sterility in insects by means of radiation; the behavior of specific nuclides in plants and soil; and related physical studies. Author (NSA)

N72-20078# Paris Univ., Orsay (France). Faculte des Sciences.
QUANTITY OF BONE MARROW WHICH MUST BE PROTECTED IN ORDER TO ENSURE THE SURVIVAL OF PIGS IRRADIATED WITH A LETHAL DOSE Ph.D. Thesis
Jean Maas 18 Jun. 1971 53 p refs In FRENCH
(FRNC-TH-97) Avail: AEC Depository Libraries

Survival after a lethal dose of radiation occurs only if sufficient bone marrow is protected or transfused. It is important to discover whether or not an irradiated animal can ensure the hemopoietic repopulation of its tissues. These problems were studied with swine which have a girth, weight, food intake, and radiosensitivity similar to man. The distribution of bone marrow was studied in swine Co-60 gamma irradiated with a dose of 890 rads; Fe-59 and Se-75 tracers were used. The degree of protection afforded by Pb screens was studied with different bones using different thickness screens and different extents of protection. It was possible in this way to calculate the number of surviving protected cells, and to evaluate the quantity of protected marrow necessary to ensure the survival of these animals. NSA

N72-20079# California Univ., Livermore. Lawrence Radiation Lab.
SENSITIVITY PROBLEMS IN BIOLOGICAL AND ENVIRONMENTAL COUNTING
G. A. Armantrout, A. E. Bradley, and P. L. Phelps Oct. 1971 25 p refs Presented at the Nucl. Sci. Symp., San Francisco, 3 Nov. 1971
(UCRL-73505; Conf-711111-6) Avail: NTIS

The general problem of sensitivity of Ge(Li) detectors for environmental counting is investigated. Analysis of biological and environmental samples differs from other physics applications in the need for very high sensitivity. A number of factors, including efficiency, geometry, resolution, and an interrelation of these, all affect sensitivity. An analysis, based on both experimental data and computations, indicates that in the range of equal detector volumes < 40 cu cm planar detectors are to be preferred over coaxial detectors due to their much better ability to quantitate data at energies below 500 keV without loss of performance at higher energies. For equal detector volumes in excess of 40 cu cm, coaxial detectors may be preferred for high energy use due to their better resolution, but performance at lower energies will still favor the planar detectors. Author (NSA)

N72-20080# Oak Ridge National Lab., Tenn.
EVALUATION OF LONG-TERM EFFECTS OF LOW LEVEL WHOLE BODY EXTERNAL RADIATION EXPOSURES
John B. Storer and Victor P. Bond Sep. 1971 10 p refs Presented at the 4th Intern. Conf. on The Peaceful Uses of Atomic Energy, Geneva, 6 Sep. 1971 Sponsored in part by AEC Prepared in cooperation with Brookhaven Natl. Lab., Upton, N. Y.
(A/Conf-49/P-82; Conf-710901-19) Avail: NTIS

Late effects of exposure to high doses of ionizing radiation were studied in a number of human populations. Particular attention was paid to the induction of neoplastic disease, although other effects such as changes in the mortality rate, ocular lens changes, and other pathologic effects were looked for in some of these populations. Extensive animal experimentation was conducted under carefully defined conditions to try to assess effects of dose rate and the shape of the dose response curves for various end points. Data from human and experimental animal studies are reviewed, and an attempt is made to assess the risk of low levels of exposure. Author (NSA)

N72-20081# California Univ., Livermore. Lawrence Radiation Lab. Bio-Medical Div.
COMPILATION OF PUBLISHED INFORMATION ON ELEMENTAL CONCENTRATIONS IN HUMAN ORGANS IN BOTH NORMAL AND DISEASED STATES. 1: RAW DATA ORDERED BY ATOMIC NUMBER, SUBORDERED BY ORGAN AND SUBORGAN, LISTING METHOD OF ANALYSIS, GEOGRAPHICAL SOURCE, AGE, SEX, NUMBER OF INDIVIDUALS
L. R. Anspaugh, W. L. Robinson, W. H. Martin, and O. A. Lowe 27 Aug. 1971 161 p refs Revised
(Contract W-7405-eng-48)
(UCRL-51013-Pt-1-Rev-1) Avail: NTIS

The elemental concentrations and other raw data (coded by number) are presented for each of the papers entered into the system. Also included is the key defining the code numbers and the reference list from which the data were obtained. The data are ordered by atomic number, subordered by organ and where appropriate by suborgan. Other information listed includes method of analysis, geographical source, age, sex, health state, concentration unit, and number of individuals. This report is primarily a listing of the raw data. Author (NSA)

N72-20082# Hungarian Academy of Sciences, Budapest.
TWO CODES FOR CALCULATION OF DOSE DISTRIBUTION IN HUMAN PHANTOMS IRRADIATED BY EXTERNAL PHOTON SOURCES
L. Koblinger [1971] 15 p refs
(KFKI-71-12) Avail: AEC Depository Libraries

Two Monte Carlo codes for calculation of dose in homogeneous or Synder-type inhomogeneous phantoms are presented. The calculation method and the possible choices of the phantom and external photon source are described. The input list and other notes for users are included. To save computer time a special method for estimation of the standard deviation is used. The codes can be applied to various problems in health physics and dosimetry; such as burden of medical x-ray application, irradiation from radioactive sources or accidental overexposure. Author (NSA)

N72-20083# Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany).
BIOCHEMICAL CHANGES IN BLOOD AND URINE INDICATING RADIATION DAMAGE: A LITERATURE REVIEW, PART-1
M. Solle and V. Orban Apr. 1971 26 p refs In GERMAN

(SZS-7/71-Pt-1) Avail: AEC Depository Libraries

A review is presented of 167 publications on radiation induced changes of the concentration of metabolites in blood and urine of several mammals and of humans. The literature was evaluated from the viewpoint of the assessment of these changes, i.e., the so-called biologic dosimetry. The material contains data on amino acids and some of their metabolites (taurine, metabolites of tryptophan, creatine, metabolites of nucleic acids, deoxyribosides, beta-amino isobutyric acid, pseudouridine, and purines) and mineral substances.

Author (NSA)

N72-20084# Lamont-Doherty Geological Observatory, Palisades, N.Y.

[DATA SYNTHESIS OF BIOLOGICAL SAMPLES COLLECTED FOR RESEARCH IN NITROGEN METABOLISM IN THE SEA] Technical Progress Report, 1 Nov. 1970 - 31 Oct. 1971

O. A. Roels, C. Garside, J. Hillegas, and J. Currie 31 Oct. 1971 185 p refs

(Contract AT(30-1)-3826)

(CU-3826-22) Avail: NTIS

The methods used for the collection and results of an experiment on nitrogen metabolism in temperate waters are discussed. Efforts were made to collect and analyze all biological and non-living particulate matter from 0.45 microns to > 10,000 microns. Samples were taken from the slope waters of the U.S. Atlantic Coast, the Gulf Stream, and the Sargasso Sea. The data analyzed include (1) annual N2 flux and the role of chemical and biological factors in the process, (2) effects of N2 metabolism in marine food chains, and (3) effects of N2 on biological productivity. An extensive appendix covers the results and conclusions in graphical and tabular form. E.H.W.

N72-20085# Rochester Univ., N.Y. Dept of Radiation Biology and Biophysics.

PRODUCTION AND CHARACTERIZATION OF AEROSOLS

T. T. Mercer 1971 42 p refs Sponsored by AEC

(UR-3490-3) Avail: NTIS

The use of monodispensed and polydispensed aerosols in investigating the hazards associated with inhalation of toxic particles and in medical treatment requiring the disposition of water droplets or particulate medication in the respiratory tract, is discussed. Some of the common methods for producing both types of aerosols, and the principles underlying those methods are also discussed. Author

N72-20086# Human Engineering Labs., Aberdeen Proving Ground, Md.

ADAPTATION LEVEL AND VISUAL SPACE PERCEPTION

Lloyd L. Avant and William Bevan Sep. 1971 30 p refs

(Contract N00014-67-A-0163-0001)

(AD-733918; HEL-TM-17-71) Avail: NTIS CSCL 05/10

A review of evidence demonstrating influence of adaptation level in the perception of the various aspects of visual space is presented. The data clearly indicate that the simplest detection of a briefly presented stimulus depends upon the spatial, temporal and chromatic properties of its surroundings. The data also demonstrate that the perception of such basic properties of spatially arrayed stimuli as extensity, location, distance and spatial organization depends upon a perceptual norm for the property being considered. Studies of geometrical illusions suggest an account of illusory perception within the formal model of adaption level theory. The problem of determining what conditions permit pooling of stimulus values to form adaptation levels is discussed. Author (GRA)

N72-20087# Naval Air Development Center, Johnsville, Pa. Crew Systems Dept.

IMPACT ANALYSIS OF THE SKULL-BRAIN SYSTEM Interim Report

Stephen L. Gordon 2 Dec. 1971 48 p refs

(AD-733986; NADC-CS-7113) Avail: NTIS CSCL 06/5

A basic one-dimensional multi-plate impact computer program has been adapted to a model of a non-penetrating blow applied to a three-layered skull and brain system. Model layer thicknesses are equal to the average size of the corresponding anatomical head layers. Three models of the skull-brain have been studied: elastic tables and elastic diploe, elastic tables and elastic-plastic diploe, elastic tables and crushable diploe. All of these models are coupled to an inviscid, compressible fluid brain. The results showed that the energy transmitted to the brain layer with these three models was in the following decreasing order: elastic, elastic-plastic, and crushable hydrodynamic foam. Several special situations with enlarged diploe thickness and increased acoustic impedance mismatch resulted in changes in the energy transmitted to the brain. The existence of potential sites of coup, contrecoup, and intermediate coup was substantiated.

Author (GRA)

N72-20088# School of Aerospace Medicine, Brooks AFB, Tex.

LISTENING LEVELS PREFERRED BY FLYING PERSONNEL Progress Report, Feb. - Jul. 1971

Harrell C. Sutherland, Jr. and Donald C. Gasaway Nov. 1971 17 p refs

(AF Proj. 7755)

(AD-734778; SAM-TR-71-44) Avail: NTIS CSCL 06/16

Speech intensity was adjusted to the preferred listening level by 65 flyers in the presence of 9 aircraft noise conditions and in quiet. The noises represented highest, lowest, and average overall levels at the pilot position in jet, propeller, and rotary-wing type aircraft. Twelve listeners also performed with dry cotton in the ear canals and another 12 with V-51R earplugs in place. Average preferred levels ranged from 79.5 to 95 dB SPL (without ear protectors) for the 9 noise conditions. Average preferred intensity in the quiet condition was 75.5 dB SPL.

Author (GRA)

N72-20089# Naval Submarine Medical Center, Groton, Conn.

ABSOLUTE DISTANCE PERCEPTION UNDER WATER AND IMPROVEMENT THROUGH TRAINING Interim Report

Steven H. Ferris 28 Jun. 1971 23 p refs

(AD-734125; NSMRL-670) Avail: NTIS CSCL 06/16

A series of experiments obtained direct estimates of absolute distance under water, and to determine if visual judgment accuracy can be improved through training. Divers were noted to learn to make accurate judgments when they were informed of the correct distance after each of a series of judgments, but training did not adequately transfer to another body of water when there were large differences in turbidity. The results have implications for the training of divers. GRA

N72-20090# Ecole Pratique des Hautes Etudes, Paris (France).

BIOPHYSICAL AND CYTOLOGICAL STUDIES WITH LASER MICROBEAMS Final Technical Report, Apr. 1970 - Mar. 1971

Marcel Bessis 1971 19 p refs

(Contract DAJA37-70-C-0678)

(AD-734181) Avail: NTIS CSCL 06/3

Microirradiation with a conventional UV source (2750A), ruby (6943), neodymium (5300 or 2650) lasers was used. The true absorption of laser light by Janus green-stained mitochondria was determined by comparison with models containing known amounts of the dye. In the same way it was possible to show that thermal denaturation is limited to the stained organelles, and to define radiation time limits. Flash photolysis with the Q-switched laser permitted the comparison of the results of exciting various chromophores of importance in cellular microirradiation. Differences between the effects produced by microirradiation with an ordinary UV source and with a laser source of the same wavelength have been noted. Upon irradiation of a small portion of the cell nucleus with an ordinary UV source cut-and-patch repair of the nucleic acid lesions was shown. Author (GRA)

N72-20091# Cincinnati Univ., Ohio. Coll. of Medicine.
RADIATION EFFECTS IN MAN: MANIFESTATIONS AND THERAPEUTIC EFFORT Annual Report, 1 May 1970 - 30 Apr. 1971
Eugene L. Saenger, Edward B. Silberstein, Bernard S. Aron, Harry Horwitz, James G. Kereiakes, I-Wen Chen, Carolyn Winget, and Goldine C. Gleser Washington Def. Nucl. Agency 1 Oct. 1971 97 p refs
(Contract DASA01-69-C-0131; DNA Proj. NWER-XAXM)
(AD-734209; DNA-2751T) Avail: NTIS CSCL 06/18

The goal of the program has been to obtain new information regarding the patho-physiologic, psychologic, immunologic, hematologic, and biochemical effects of total- and partial-body irradiation in human beings. The patients are irradiated, all of whom have inoperable, metastatic carcinoma but are in relatively good health, provide the opportunity to study multiple facets of the effects of radiation in man rather than in experimental animal. Many laboratories have discovered that the extrapolation of results from laboratory animals to man to be fraught with error. The data contained in this report will suggest several potential biological dosimeters previously considered to be of some value have not fulfilled this expectation. Several new biological dosimeters are under evaluation. Author (GRA)

N72-20092# California Univ., Los Angeles. School of Engineering and Applied Science.
UNDERWATER WORK MEASUREMENT TECHNIQUES Final Report
Gershon Weltman, Glen H. Egstrom, Michael A. Willis, and William Cuccaro Jul. 1971 63 p refs
(Contract N00014-67-A-0111-0007; NR Proj. 196-069)
(AD-734014; UCLA-ENG-7140; TR-50) Avail: NTIS CSCL 05/10

The fourth and concluding report is given in a series describing yearly progress of the UCLA Research Project on optimum underwater work measurement techniques. The previous reports have covered studies conducted in 1967, 1968 and 1969. This report, in addition to presenting the two major studies carried out in 1970, also provides a summary of work over the four year period. The cumulative list of project publications allows the reader to identify a topic of concern, determine primary findings, and explore the topic further in the literature or by reprint request. GRA

N72-20093# Randomline Inc., Willow Grove, Pa.
ON THE NATURE OF ELECTROSENSING IN THE FISH
Allan H. Frey and Edwin E. Eichert, III Aug. 1971 76 p refs
(Contract N00014-69-C-0181)
(AD-734027) Avail: NTIS CSCL 06/3

An evaluative review of the electrosensing literature on fish was carried out with the intention of determining the nature of the electrosensing mechanism and its sensitivity. The biological data base was useful in the development of a mathematical model and a mathematical analyses of the sense mechanism and its function. In the course of the analyses, a working hypothesis is suggested on the nature of the sense mechanism. The function of the mathematical model developed for the sensor was explored with the use of a computer. The fishes' function at the system level was also considered and possible mechanisms defined. GRA

N72-20094# Army Medical Research Lab., Fort Knox, Ky.
AUDITORY EMG FEEDBACK DURING A SUSTAINED SUBMAXIMUM ISOMETRIC CONTRACTION Interim Report
Andree J. Lloyd 20 Sep. 1971 13 p refs
(DA Proj. 3A0-61102-B-71-P)
(AD-734300; USAMRL-949) Avail: NTIS CSCL 06/16

Two groups of male volunteers maintained a submaximum isometric contraction of the elbow flexors to exhaustion. During the endurance session, each subject was required to exert a force equal to 50% of his maximum voluntary strength and to subjectively rate the increasing intensity of pain resulting from the isometric pull. Continuous recordings of electromyographic activity of the biceps muscle were accomplished through standard surface electrode techniques. The experimental group was provided with direct auditory feedback of the EMG signals. Although endurance time did not increase when auditory EMG was provided, the level of muscle activity required to sustain the contraction was significantly reduced. These results suggested that auditory EMG provided a situation where the endurance task was accomplished with greater efficiency. Author (GRA)

N72-20095# Army Medical Research Lab., Fort Knox, Ky.
LATENCIES FOR MOVEMENT NAMING WITH CONGRUENT AND INCONGRUENT WORD STIMULI Progress Report
Frederick N. Dyer 17 Sep. 1971 14 p refs
(DA Proj. 3A0-61102-B-71-P)
(AD-734299; USAMRL-948) Avail: NTIS CSCL 05/10

Naming of movement directions was found to be almost immune to interference from incongruent names integrated with the movement stimuli. This is in sharp contrast to the large delay of color naming when colors and incongruent color names are combined in the Stroop test. A hypothesis that faster processing of movement directions than of colors is the basis of the difference in interference was tested by beginning the processing of the words at various intervals prior to their movement. No appreciable increase in interference resulted from these stationary preexposures of the words. The absence of naming interference for movement direction and other dimensions suggests a basic difference between the cortical processing of color and other dimensions. Author (GRA)

N72-20147# Joint Publications Research Service, Arlington, Va.
APPLICATION OF BIOTELEMETRY FOR RESEARCH IN THE PHYSIOLOGY OF LABOR AND SPORTS: EQUIPMENT FOR STUDYING FREELY MOVING PEOPLE
R. V. Unzhin and L. S. Dombrovskiy *In its* Biol. Telemetry 6 Mar. 1972 p 107-141 refs (See N72-20143 11-07)
Avail: NTIS

N72-20148# Joint Publications Research Service, Arlington, Va.
APPLICATION OF BIOTELEMETRY IN PHYSIOLOGY OF LABOR AND SPORTS
V. V. Rozenblat and L. S. Dombrovskiy *In its* Biol. Telemetry 6 Mar. 1972 p 142-175 refs (See N72-20143 11-07)
Avail: NTIS

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-20096* Litton Industries, Beverly Hills, Calif.
LIFE SUPPORT SYSTEM Patent
Daniel L. Curtis, inventor (to NASA) Issued 18 Jan. 1972 8 p Filed 29 Jan. 1968 Sponsored by NASA
(NASA-Case-MSC-12411-1; US-Patent-3,635,216; US-Patent-Appl-SN-701244; US-Patent-Class-128-142.5; US-Patent-Class-128-402; US-Patent-Class-2-2.1) Avail: US Patent Office CSCL 06K

A description is given of a lightweight life support system for extravehicular space activity. The system may be mounted in a back pack or integrated into a protective suit. Two subsystems are provided to maintain the suit inhabitant in his environment. The first subsystem is an open loop, single pass ventilation system, having a high-pressure oxygen and mixed gas storage which is maintained within lightweight, stress-limited pressure vessels. A breathing bag cooperates with the open loop system

to meet the peak respiratory demands. The second subsystem comprises a protective suit having a duct network, a liquid pump, and a sublimator-heat exchanger which in combination provide a suitable thermal condition.
Offical Gazette of the U.S. Patent Office

N72-20097* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
UNDERWATER SPACE SUIT PRESSURE CONTROL REGULATOR Patent
Billy R. Aldrich, Charles R. Cooper, inventors (to NASA), and John R. Rasquin Issued 25 Jan. 1972 17 p Filed 24 Oct. 1969
(NASA-Case-MFS-20332; US-Patent-3,636,966; US-Patent-Appl-SN-869260; US-Patent-Class-137-81; US-Patent-Class-137-469) Avail: US Patent Office CSCL 06K

A device for regulating the pneumatic pressure in a ventilated space suit relative to the pressure imposed on the suit when being worn by a person underwater to simulate space environment for testing and experimentation is described. A box unit located on the chest area of the suit comprises connections for suit air supply and return lines and carries a regulator valve that stabilizes the air pressure differential between the inside and outside of the suit. The valve and suit pressure are controlled by the suit occupant and the valve includes a mechanism for quickly dumping the suit pressure in case of emergency. Pressure monitoring and relief devices are also included in the box unit.
Official Gazette of the U.S. Patent Office

N72-20098* United Aircraft Corp., Windsor Locks, Conn.
METHOD OF FORMING A ROOT CORD RESTRAINED CONVOLUTE SECTION Patent
Michael A. Marroni, Jr. and John J. Korabowski, inventors (to NASA) Issued 7 Dec. 1971 5 p Filed 20 Dec. 1968 Sponsored by NASA
(NASA-Case-MSC-12398; US-Patent-3,624,839; US-Patent-Appl-SN-785615; US-Patent-Class-2-2.1) Avail: US Patent Office CSCL 06Q

Root cords utilized to constrain restraint fabric so as to form convolutes in a pressurized suit are slidably disposed on the fabric, thereby permitting fabrication of root restrained fabric suit sections from sheets of fabric. This also permit adjustability of root diameters to vary the sizes of suits, and to accommodate minor tailored changes to improve comfort and mobility when the suit is being worn. Cords are restrained by stitching and cloth tunnels. Official Gazette of the U.S. Patent Office

N72-20099# International Business Machines Corp., Philadelphia, Pa. Data Processing Div.
A TECHNIQUE FOR THE SOLUTION OF MASSIVE SET COVERING PROBLEMS, WITH APPLICATION TO AIRLINE CREW SCHEDULING
Jerrold Rubin Sep. 1971 29 p refs
(TR-320-3004) Avail: NTIS

Recent set covering algorithms were able to solve problems for which the constraint matrix has as many as 10,000 columns. In certain applications, the number of columns is combinatorially dependent on the number of rows, and can reach many orders of magnitude greater, for 500-1000 rows. For these problems, the constraint matrix cannot be generated, unless severe ad hoc limitations are imposed. One method of attack is to repeatedly use a set covering algorithm on much smaller matrices extracted from the overall problem, generating columns as needed. Such an approach was used on an airline crew scheduling problem, with excellent practical success on test cases involving close to 1000 rows. It utilizes some techniques which are more generally applicable, and some which make use of the structure of the crew scheduling problem. Author

N72-20100# International Business Machines Corp., Philadelphia, Pa. Data Processing Div.
AIRLINE CREW SCHEDULING: THE NON-MATHEMATICAL PROBLEM
Jerrold Rubin Sep. 1971 18 p refs
(TR-320-3006) Avail: NTIS

Methods of overcoming some difficulties for airline crew scheduling are reviewed. Several generalizations and analogies are drawn which may be applied to other areas. Author

N72-20101# Human Resources Research Organization, Alexandria, Va.
HUMAN RESOURCES RESEARCH ORGANIZATION BIBLIOGRAPHY OF PUBLICATIONS AS OF 30 JUNE 1971
Sep. 1971 363 p refs
Avail: NTIS HC $6.00/MF $0.95

The Human Resources Research Organization (HumRRO) bibliography of publications as of 30 June, 1971 is presented. The reporting items issued during FY 1971 are listed separately as well as in the cumulative total output. Abstracts have been provided for most items in the cumulative list. A comprehensive and descriptive listing of research projects and experimental materials has been compiled. Author

N72-20102*# Naval Aerospace Medical Inst., Pensacola, Fla.
GOGGLE DEVICE FOR MEASURING THE VISUALLY PERCEIVED DIRECTION OF SPACE
Earl F. Miller, II and Ashton Graybiel 30 Nov. 1971 6 p refs
(NASA Order T-81633; NASA Order L-43518)
(NASA-CR-125859; NAMRL-1151) Avail: NTIS CSCL 06B

A detailed description is given of a miniature line-target system that is illuminated by a radioactive source, collimated, and provided with suitable scales to indicate its position within the roll and pitch planes. These components are assembled in a lightweight, goggle that can be precisely positioned by means of a biteboard attachment. Uses of the goggle in the measurements of the perceived direction of space under ordinary and extraordinary test conditions are illustrated. Modifications are suggested that can extend its usefulness. Author

N72-20103*# National Academy of Sciences-National Research Council, Washington, D.C. Space Science Board.
HUMAN FACTORS IN LONG-DURATION SPACE FLIGHT
1972 283 p refs
(Contract NSR-09-012-911)
(NASA-CR-125826; LC-70-189063; ISBN-0-309-01947-8) Avail: NTIS; Printing and Publishing Office, NAS, 2102 Constitution Ave., Washington, D. C. 20418 CSCL 05E

A study, covering the behavioral, psychological, physiological, and medical factors of long duration manned space flight, is presented. An attempt was made to identify and resolve major obstacles and unknowns associated with such a flight. The costs and maintenance of the spacecraft system are also explored.
E.H.W.

N72-20104# RAND Corp., Santa Monica, Calif.
THE BIOMOD USER'S REFERENCE MANUAL
R. L. Clark, G. F. Groner, and R. A. Berman Jul. 1971 146 p refs
(Grant GM-15896)
(R-746-NIH) Avail: NTIS

BIOMOD is a computer graphics system for modeling continuous systems. It features man machine interaction, hierarchical model structuring, and user oriented model definition languages. The user communicates with BIOMOD by using a data tablet to draw diagrams, handprint text, and activate program functions; he may also enter text through a keyboard. The user's input and the systems's responses are displayed on a cathode ray tube display screen. The user deals with two phases of BIOMOD: a construction phase, in which he describes a model, and simulation phase, which calculates and displays the results, and which allows him to interact with the simulation. A model is described by a block diagram. Each block of the diagram may represent an analog computer-like primitive function,

a set of mathematical (algebraic or differential) equations, a set of chemical equations, a set of FORTRAN statements, or another block diagram. The simulation phase displays the values of simulation variables, either numerically or graphically, as the simulation proceeds. The simulation may be stopped at any point. Author

N72-20105*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
WHOLE BODY MEASUREMENT SYSTEM Patent Application
John S. Ogle, inventor (to NASA) Filed 18 Nov. 1971 13 p
(Contract NAS9-10742)
(NASA-Case-MSC-13972-1; US-Patent-Appl-SN-200040) Avail: NTIS CSCL 06B

A biomedical system for quantitatively determining the volume and volume change of a human body under weightlessness conditions, over a period of time, is described. The system consists of an enclosed chamber having a defined volume and arranged for receiving a human body. The system is provided with a means for infrasonically varying the volume of the chamber. The changes in volume produce resultant changes in pressure, and under substantially isentropic conditions, an isentropic relationship permits a determination of gas volume which, in turn, when related to total chamber volume permits a determination of the body volume. By comparison techniques, volume changes of a human independent of gravity conditions can be determined. NASA

N72-20106*# General Electric Co., Philadelphia, Pa.
AIR-CONDITIONED SUIT Patent Application
George R. Carl, inventor (to NASA) Filed 27 Oct. 1970 11 p
(Contract NAS1-6537)
(NASA-Case-LAR-10076-1; US-Patent-Appl-SN-84290) Avail: NTIS CSCL 06K

An environmentally controlled suit consisting of an airtight outergarment attached by an airtight bellows to the wall of a sterile chamber, an undergarment providing for circulation of air near the skin of the wearer, and circulation system comprised of air supply and distribution to the extremities of the garment and central collection and exhaust of air from the midsection of the undergarment has been developed. A workman wearing the undergarment and attached circulation system enters the outer garment through a tunnel in the chamber wall and the attached bellows to work in the chamber without any danger of spreading bacteria. NASA

N72-20107# Joint Publications Research Service, Washington, D.C.
HIGH ALTITUDE EQUIPMENT FOR CIVIL AVIATION AIRCRAFT
N. G. Grishanov 16 Mar. 1972 274 p refs Transl. into ENGLISH of the book "Vysotnoye Oborudovaniye Samoletov Grazhdanskoy Aviatsii" Moscow, Transport Publishing House, 1971 264 p
(JPRS-55454) Avail: NTIS

The physiological effects of high altitude flight and the development of life support systems for civil aircraft are discussed. Subjects presented are: (1) pressurized aircraft cabins, (2) aircraft cabin air conditioning systems, (3) aircraft oxygen systems, (4) aircraft cabin temperature and humidity control systems, and (5) servicing and maintenance of pressurized cabins and high altitude equipment. Line drawings of various items of equipment and systems are provided for clarification. P.N.F.

N72-20108*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF A SPECIALIZED COMPUTER FOR ON-LINE MONITORING OF CARDIAC STROKE VOLUME
John A. Webb, Jr. and Vernon D. Gebben Washington Apr. 1972 36 p refs
(NASA-TN-D-6658; E-6376) Avail: NTIS CSCL 06B

The design of a specialized analog computer for on-line determination of cardiac stroke volume by means of a modified version of the pressure pulse contour method is presented. The design consists of an analog circuit for computation and a timing circuit for detecting necessary events on the pressure waveform. Readouts of arterial pressures, systolic duration, heart rate, percent change in stroke volume, and percent change in cardiac output are provided for monitoring cardiac patients. Laboratory results showed that computational accuracy was within 3 percent, while animal experiments verified the operational capability of the computer. Patient safety considerations are also discussed. Author

N72-20109*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
URINE SAMPLING AND COLLECTION SYSTEM Final Report
G. L. Fogal, J. K. Mangialardi, and C. G. Reinhardt Nov. 1971 162 p refs
(Contract NAS9-10741)
(NASA-CR-115507; DOC-70SD5414) Avail: NTIS CSCL 06B

This specification defines the performance and design requirements for the urine sampling and collection system engineering model and establishes requirements for its design, development, and test. The model shall provide conceptual verification of a system applicable to manned space flight which will automatically provide for collection, volume sensing, and sampling of urine. Author

N72-20110*# General Electric Co., Philadelphia, Pa. Space Div.
GENERAL PURPOSE BIOAMPLIFIER STUDY IMBLMS phase B4 additional tasks. Task 4.0
[1972] 45 p
(Contract NAS9-10741)
(NASA-CR-115506; DOC-70SD5414) Avail: NTIS CSCL 06B

Based on known inputs and outputs, a set of specifications were developed for the major characteristics of a general purpose amplifier for use in the Integrated Medical, Behavioral, and Laboratory Measurement System. A.L.

N72-20111*# North American Rockwell Corp., Los Angeles, Calif.
AN IMPROVED PROSTHETIC DEVICE Patent Application
Walter L. Scott, inventor (to NASA) Filed 22 Feb. 1972 15 p Sponsored by NASA
(NASA-Case-MFS-16570; US-Patent-Appl-SN-228150) Avail: NTIS CSCL 06B

A prosthetic device with transducers for applying tactile stimuli to the stump of an amputated appendage is described. The sensors are supported in several flexible digits. There is also a slave unit for transporting the detected stimuli. The device is designed to specifically detect heat and pressure. NASA

N72-20112*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ERGOMETER Patent Application
Raymond L. Gause and Bobby G. Bynum, inventors (to NASA) Filed 29 Nov. 1971 18 p
(NASA-Case-MFS-21109; US-Patent-Appl-SN-202769) Avail: NTIS CSCL 06B

An ergometer system, which provides enhanced versatility in operation and more effective control of the work load imposed upon a body undergoing conditioning, is described. The system is composed of a pedal driven direct current motor, a frame for supporting the body in either a sitting or prone position, and an electric circuit means by which the load applied to the pedals is limited. To determine the load limit, the circuit measures the function of work being performed, the heart rate, and increases in heart rate. The ergometer system may be operated by hand or by foot. E.H.W.

N72-20113*# Quantum Dynamics, Tarzana, Calif.
RESPIRATORY ANALYSIS SYSTEM Patent Application
Frederick F. Liu, inventor (to NASA) Filed 19 Aug. 1971 19 p
Sponsored by NASA
(NASA-Case-MSC-13436-1; US-Patent-Appl-SN-173190) Avail: NTIS CSCL 06B

A system for quantitatively analyzing the human respiratory processes in real time is described. The system is composed of a face mask with one way inlet and outlet valves where the gas flows through independent flowmeters and a mass spectrometer. The inhalation and exhalation are measured from the signals given off by opening and closing the valve system. The flowmeter produces electric pulses representative of the flow rate. The two systems are then connected to a computer for real time measurement by a one minute clock pulse. E.H.W.

N72-20114*# Emory Univ., Atlanta, Ga.
IMPROVED DIALYZER Patent Application
David A. Miller, inventor (to NASA) Filed 27 Apr. 1971 28 p
(Grant NGR-11-001-009)
(NASA-Case-HQN-10741; US-Patent-Appl-SN-137913) Avail: NTIS CSCL 06B

An improved dialyzer for use in separating selected substances from a uniformly flowing body of fluid by diffusing the substance through a plurality of semi-permeable membranes into a counter-flowing body of dialysate is described. Each of the membranes is supported between a pair of planar mats, one of which is provided with a substantially smooth surface while the other is provided with a uniform arrangement of protuberances substantially conforming to right circular cones with the apexes extended into deforming engagement with the adjacent surface of the membrane. With this arrangement, the opposite surface of the membrane is forced into a point-contact engagement with the smooth surface of the mat so that a fluid chamber having a plurality of angularly related channels is established for conducting the fluid along angularly related multiple paths. NASA

N72-20115# Welson (B.) and Co., Inc., Hartford, Conn.
A ROCKET PROPELLANT HANDLER'S SUIT FOR PROTECTION FROM CHLORIDE TRIFLUORIDE AND ELEMENTAL FLUORINE Final Technical Report, Sep. 1969 - Oct. 1970
Joseph A. Martone and Gail A. Bergen Edwards AFB, Calif. AFRPL Aug. 1971 65 p refs
(Contract F04611-69-C-0102; AF Proj. 3058)
(AD-731556; AFRPL-TR-71-44) Avail: NTIS CSCL 06/17

Extremely powerful and highly toxic oxidizers such as fluorine (F2) and chlorine trifluoride (ClF3) are currently being studied at the Air Force Rocket Propulsion Laboratory. A prototype propellant handler's suit for protection against gaseous fluorine and liquid chlorine trifluoride has been developed and operationally tested. The exposed components of this garment are made of perfluoropolymers and stainless steel. The complete suit and sample components were exposed to both gaseous fluorine and liquid chlorine trifluoride. The suit reacted with liquid chlorine trifluoride and therefore failed to pass the operational test. Author (GRA)

N72-20116# Anacapa Sciences, Inc., Santa Barbara, Calif.
APPLICATION AND DESIGN CHARACTERISTICS OF GENERALIZED TRAINING DEVICES Final Report, 1970 - 1971
Edward L. Parker Orlando, Fla. Naval Training Device Center Sep. 1971 107 p
(Contract N61339-70-C-0309)
(AD-733471; NAVTRADEVCEN-70-C-0309-1) Avail: NTIS CSCL 05/9

The purpose of the research reported was to identify areas of Naval electronic training that can potentially benefit from the development of generalized training devices, and to define the design and use characteristics of several such devices as appropriate. By direction, the primary emphasis of the study was on maintenance training, with the technical approach developed as also applicable to operator training. The single most promising generalized training device has been identified and its characteristics are discussed in considerable detail. GRA

N72-20117# Naval Personnel and Training Research Lab., San Diego, Calif.
INFORMATION FEEDBACK: CONTRIBUTIONS TO LEARNING AND PERFORMANCE IN PERCEPTUAL IDENTIFICATION TRAINING Final Technical Bulletin
Alvin J. Abrams and Richard L. Cook Dec. 1971 21 p refs
(AD-733451; STB-72-5) Avail: NTIS CSCL 05/9

In training people to perform auditory identification tasks (e.g., training students to identify sound characteristics in a sonar classification task) it is important to know whether or not training procedures are merely sustaining performance during training or whether they enhance learning of the task. Often an incorrect assumption is made that superior performance during training is synonymous with a high level of learning. Two experiments were run in which the pacing of stimulus complexity and the fading of informational feedback (IF) were systematically varied. It was found that: The pacing of stimulus complexity during training serves to enhance the learning effectiveness of IF; continuous IF serves primarily to sustain performance, while fading IF enhances learning; the learning enhancement effect of IF is greatest when judgments of a stimulus dimension are made on a previously learned absolute scale, while the performance sustaining effect of IF is greatest when judgments of a stimulus dimension are made on a novel, relative scale. Author (GRA)

N72-20118# Dunlap and Associates, Inc., Darien, Conn.
TRAINING DEVICE EMPLOYMENT MATERIALS
Gabriel G. Jeantheau Orlando, Fla. Naval Training Device Center Nov. 1971 84 p refs
(Contract N61339-70-C-0189)
(AD-733962; NAVTRADEVCEN-70-C-0189-1) Avail: NTIS CSCL 05/9

The study organized and analyzed a collection of training materials solicited from approximately one hundred training device activities in order to examine the similarities and differences among the collection, to make a preliminary determination of their training value, and to determine their utility for guidance in the preparation of materials for future devices. Criteria for effective materials that derive directly from criteria for effective device use were applied to the sample. Noteworthy documents are observed for trainers in aircraft weapon system trainers. Examples of selected ingredients are provided, and recommendations are made for improved solicitation procedures for future additions to the collection and for a study of the methodology of problem development. GRA

N72-20119# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TECHNICAL FACILITIES SUMMARY
Denton M. Mays, comp. Nov. 1971 77 p
(AD-734544; AMRL-TR-71-54) Avail: NTIS CSCL 06/12

The report identifies the major technical research and development facilites used by the aerospace medical reserach laboratory. Basic information, such as specifications, capabilities, and technical applications of these facilities, is provided. These facilities represent the critical link in the total integration of the laboratory resources toward accomplishing the stated mission (conducting human engineering and biomedical research): (1) defining the limits of human tolerances, (2) establishing human performance capability, and (3) establishing design criteria for Air Force systems. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-20120 National Lending Library for Science and Technology. Boston Spa (England).

X-RAY FLUORESCENCE ANLAYSIS OF IRON, COBALT, NICKEL, AND COPPER IN ALNICO ALLOYS BY AQUEOUS SOLUTION METHOD

H. Goto and F. Maeda Jan. 1972 16 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Sendai City), v. 33, no. 12, 1970 p 1396-1399

(NLL-RTS-6783) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.60 or 5 NLL photocopy coupons

X-ray fluorescence analysis by an aqueous solution method has the following advantages: (1) as homogeneous measurement samples are obtained, there is no error caused by segregation; (2) samples and standard samples can be prepared easily; (3) by use of identical samples, iron, cobalt, nickel, and copper are measured rapidly with a high accuracy; and (4) the absorption effect or emphasis effect between elements is reduced by dilution. A calculation method using a correction formula for the X-ray fluorescence absorption effects and emphasis effects was tentatively used for estimation of iron, cobalt, nickel, and copper, and it proved to be a rapid analysis method with good results. Samples were prepared by nitric acid-hydrofluoric acid dissolution which is believed to have the slightest effect on absorption. Author

N72-20121* Peninsular ChemResearch, Inc., Gainesville, Fla.

PERFLUORO POLYETHER ACYL FLUORIDES Patent

Eugene C. Stump and Stephen Eugene Rochow, inventors (to NASA) Issued 25 Jan. 1972 4 p Filed 24 Oct. 1968 Sponsored by NASA

(NASA-Case-NPO-10765; US-Patent-3,637,842; US-Patent-Appl-SN-770425; US-Patent-Class-260-544F) Avail: US Patent Office CSCL 07C

Perfluoro polyethers are described having the formula X(CF(CF3)O(CF2) sub P OCF(CF3)) sub n X, where n is an integer from 2 to 12 and p is an integer from 2 to 23. Official Gazette of the U.S. Patent Office

N72-20122# Pennsylvania State Univ., University Park. Ionospheric Research Lab.

THE BROMINE ATOM CATALYZED OXIDATION OF CARBON MONOXIDE

Eduardo Lissi, R. Simonaitis, and Julian Heicklen 26 Jan. 1972 17 p refs

(Grant NSF GA-12385)

(PSU-IRL-SCI-385; SR-385) Avail: NTIS

The Br2 was photolyzed at 3600 A and 25 C in the presence of 02 and CO. Carbon dioxide was produced according to a given rate law. The full mechanism is outlined, and the reaction steps are discussed. Author

N72-20123# Royal Aircraft Establishment, Farnborough (England).

INVESTIGATION OF THE EFFECT OF THE DEGREE OF CROSS-LINKING AND THE MECHANICAL PROPERTIES OF COPOLYMERS OF UNSATURATED POLYESTERS

N. S. Maizel, L. N. Sedov, N. I. Mozzhechkova, N. F. Pugachevskaya, and V. E. Gul Sep. 1971 10 p refs Transl. into ENGLISH from Vysokomol. Soedin. (USSR), v. 12b, no. 10, 1970 p 732-736

(RAE-Lib-Trans-1590; BR-27848) Avail: NTIS

The dependence of failure stress and strain on the degree of crosslinking and temperature was investigated for a series of unsaturated polyesters based on polyethylene glycol and maleic anhydride, crosslinked by copolymeriation with styrene. Author

N72-20124# Technische Univ., Berlin (West Germany).

ON THE INFLUENCE OF PHENOL- AND AMINE-BASIS INHIBITORS ON THE THERMAL OXIDATION OF n-HEXADECANE IN THE TEMPERATURE RANGE FROM 150 TO MAXIMUM OF 200 C Ph.D. Thesis [UEBER DEN EINFLUSS VON INHIBITOREN AUF PHENOL- UND AMINBASIS BEI DER THERMOOXYDATION VON n-HEXADECAN IM TEMPERATURBEREICH VON 150 BIS MAX 200 C]

Ingo Jung 1971 116 p refs In GERMAN

Avail: NTIS

The effect of phenol and amine type inhibitors on the thermal oxidation of n-hexadecane in the temperature range from 150 to 200 C is discussed. The chemical reaction of auto-oxidation is described. The application of gas chromatography for analysis of the oxidation products is explained. Tables and charts are included to clarify the experimental results. Infrared spectroscopy is recommended as another means of analyzing the gas phase of the chemical reaction. Transl. by P.N.F.

N72-20125# Council for Scientific and Industrial Research, Pretoria (South Africa).

EFFECT OF THE FLUORIDE ION ON ALUMINIUM, IN ELECTROLYTES CONTAINING ZINC

S. Pozzoli and A. Bianchini Feb. 1971 16 p refs Transl. into ENGLISH from Chim. Ind. (Milan), v. 51, no. 3, 1969 p 263-268

(Rept-907) Avail: NTIS

A description is given of an electrochemical technique, based on plotting measurements of static potential which shows the effect of a small quantity of fluoride ions (10 to 30 mg/l) on an aluminum surface. It was confirmed that the effect is a surface pickling action which is translated into a displacement of the aluminum potential towards more negative values. The method is applicable to the study of the effect of the fluoride ions on aluminum cathodes used in the industrial electrolysis of zinc. The method is simple to apply and yields reproducible and, within certain limits, quantitative results. Author

N72-20126# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

ACTIVITIES OF THE NBS SPECTROCHEMICAL ANALYSIS SECTION, JULY 1970 - JUNE 1971

K. F. J. Heinrich and S. D. Rasberry Jan. 1972 131 p refs

(NBS-TN-582) Avail: SOD $1.25 as C 13.46:582

Research on the following topics is considered: optical spectroscopy, X-ray fluorescence spectrometry, electron probe microanalysis, and preconcentration techniques. Personnel and changes in facilities are listed. Certificates are presented for National Bureau of Standards standard reference materials which were recently issued. A schematic for an electron beam scanning system is also included. K.P.D.

N72-20127*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Astropower Lab.

NEW POLYMERS OF PERFLUOROBUTADIENE AND METHOD OF MANUFACTURE Patent Application

Madeline S. Toy, inventors (to NASA) and James M. Newman Filed 19 May 1971 13 p

(Contract NAS7-603)

(NASA-Case-NPO-10863-2; US-Patent-Appl-SN-145026) Avail: NTIS CSCL 07D

A polyperfluorobutadiene is described, which is a copolymer of perfluoro-1,2- and 1,4-butadiene. One method of initiating the polymerization of the perfluorobutadiene utilizes diisopropyl peroxydicarbonate. NASA

N72-20128*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF SURVEYOR 3 TELEVISION CABLE AFTER RESIDENCE ON THE MOON

Frederick C. Gross and John J. Park Washington Mar. 1972

14 p
(NASA-TN-D-6599; G-1044) Avail: NTIS CSCL 07D

The Apollo 12 astronauts brought the Surveyor III television camera back from the moon in November 1969. Chemical analyses of a portion of television cable revealed changes in the glass fabric sleeve and in the wire insulation as a result of exposure to the lunar environment. Loss of volatile constituents from the glass fabric and a discoloration of the glass occurred. The Teflon layer on the wire showed a slight discoloration and possibly a slight change in its infrared spectrum. Both the polyimide layer and the Teflon layer of the wire insulation showed changes in tensile strength and elongation. Author

N72-20129*# Scientific Translation Service, Santa Barbara, Calif.
INTERACTION OF SODIUM CHLORIDE AND KAOLIN AT HIGH TEMPERATURES
I. I. Kitaygorodskyy and V. I. Bokunyayeva Washington NASA Apr. 1972 13 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), V. 8, no. 2, 1935 p 230-237
(Contract NASw-2035)
(NASA-TT-F-14264) Avail: NTIS CSCL 07D

The reaction between sodium chloride and kaolin was studied at high temperatures. The charge containing 15% sodium chloride yielded the best results, and the optimum temperature was established as 1000 C. Author

N72-20130# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Werkstoff-Forschung.
THE INFLUENCE OF THE CATION ON THE BEHAVIOUR OF THE PASSIVE FILM ON AlMg-7 ALLOYS IN CHLORIDE SOLUTIONS
L. Z. Ostrowski and H. Buhl 1971 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-88) Avail: NTIS; DFVLR Porz-Wahn: 11,40 DM

The stress corrosion cracking mainly depends on the properties of the specifically built up passive film. With aluminium-magnesium-alloys the existing film can be porous to a different degree. The kind of influence the various cations have on the sensibility of the passive film in aqueous solutions with chloride ions was investigated. In the light of electrochemical measurements, as there are polarization measurements and pH-measurements, it was proved that a different passive film can be built up and that different corrosion currents flow through the alloy interface. In the light of the results there can be assumed a connection between the size of the atomic volume of the cation which is contained in the passive film as well as the porosity and the stability of this passive film. Author

N72-20131*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICALLY CONDUCTIVE POLYFLUORINATED ETHYLENE Patent Application
Harold F. Leibecki, inventor (to NASA) Filed 22 Jan. 1970 9 p
(NASA-Case-XLE-06774-2; US-Patent-Appl-SN-05114) Avail: NTIS CSCL 07D

Fluorocarbon polymers are impregenated with rhenium or molybdenum by immersion in liquid rhenium hexafluoride or molybdenum hexafluoride. The rhenium and molybdenum fluoride compounds are then hydrolyzed to form conductive oxides. The impregnated polymer is electrically conductive. NASA

N72-20132# National Research Council of Canada, Ottawa (Ontario).
THE ELASTIC CONSTANTS OF THE NEMATIC PHASE OF AZOXYANISOLE
A. Saupe 1972 19 p refs Transl. into ENGLISH from Z. Naturforsch. (W. Germany), v. 15a, no. 9, 1960 p 815-822
(NRC-TT-1533) Avail: NTIS

The behavior of nematic films in magnetic fields due to wall effect was studied from the standpoint of a phenomenological theory and is used to determine the longitudinal and transverse flexural elastic constants. Both constants were obtained in two ways: for films in parallel orientation and for films in perpendicular orientation. The results differed considerably, presumably due to the failure of the boundary conditions in the perpendicularly-oriented films. Author

N72-20133# Bochum Univ. (West Germany).
CONCERNING THE REACTIONS BETWEEN NICKEL AND ALANINE, BORON AND LITHIUM ALKALIES Ph.D. Thesis [WEBER WECHSELWIRKUNGEN ZWISCHEN NICKEL UND ALANEN, BORANEN SOWIE LITHIUMALKYLEN]
Reinhold Stabba 6 Jul. 1972 109 p refs In GERMAN
Avail: NTIS

The chemical reactions between nickel compounds and organic metal compounds of the intermediate metals, alanin, boron, and lithium were investigated. During the investigation, pure olefin complexes, such as bis-cyclooctadien and nickel reactions were included. Where possible definite complexes were isolated and additional indications of the reaction of nickel during the nickel effect were enlarged. Chemical formulas are presented to describe the reactions of the nickel compounds and models of the crystal structure are included to support the chemical theory. The use of spectroscopy to confirm the results of the chemical reactions is discussed. Transl. by P.N.F.

N72-20134# Arkansas Univ., Fayetteville. Dept. of Chemistry.
NUCLEAR AND COSMOCHEMISTRY Annual Progress Report
31 Jul. 1971 25 p refs
(Contract AT(40-1)-3235)
(ORO-3235-72) Avail: NTIS

Brief summaries of research on origin and age of the elements, nuclear spectroscopy, fission studies, and instrumentation are presented. A list of papers published or in press is appended. NSA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-20135 National Lending Library for Science and Technology, Boston Spa (England).
DATA COMPRESSION ON THE FOURIER TRANSFORMED FUNCTION OF A PICTURE
Ph. Marano and P. Y. Schwartz 7 Feb. 1971 25 p refs Transl. into ENGLISH from l'Onde Elec. (Paris), v. 50, no. 11, Dec. 1970 p 908-919
(NLL-Trans-2750-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A short resume of data compression methods is presented, justifying the use of overall compression methods. Two examples (an aerial photograph and a photograph of a child) are given for the statistical properties of the Fourier transformed (probability law of distribution of moduli and spatial distribution of moduli below a given threshold). Compression ratios were calculated from these results. In conclusion some compression results of the specification of picture degradation are presented and the possibilities for realizing a system for real time operation are considered. Author

N72-20136 National Lending Library for Science and Technology, Boston Spa (England).
THE PARAMETERS OF A SLOT EMITTER ON A PI-WAVEGUIDE

V. A. Lyashchenko Jan. 1972 12 p refs Transl. into ENGLISH from Vuz. Radioelektron (USSR), v. 14, no. 1, Jan. 1971 p 49-55
(NLL-BR-30072; NLL-DRIC-Trans-2551-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The dependence of the coefficients of radiation and reflection on the length of a slot, on its orientation on the Pi-waveguide, and on the critical and working length of a wave was investigated. Experimental verification of the results is presented. Author

N72-20137 National Lending Library for Science and Technology, Boston Spa (England).
ADVANCED RING-TYPE CHANNEL-DROPPING FILTERS
S. Shimada, Isao Ootomo, Hikaru Hirotani, and Kunio Ohi 2 Feb. 1970 24 p refs Transl. into ENGLISH from Tech. J. of the Elec. Commun. Lab. of Japan, v. 18, no. 12, 1969 p 3331-3346
(NLL-Trans-2816-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The use of branch waveguide type directional couplers instead of the multicavity type for making ring-type filters for use in millimeter wave communications is described. Experiments carried out using two ring-type resonators showed that losses were as low as those of the conventional multicavity type. In order to forecast the future of using a higher frequency, experiments were carried out with ring-type filters using multicavity directional couplers in the 70 GHz band. Because of the presence of some unsolved technical problems, losses were rather large, amounting to 1.6 db in filtration loss and 0.3 db in transmission loss at a resonant frequency of 68.7 GHz in the 500 MHz band having a width of 3 db. Experiments also proved that resonant frequency can be varied without deterioration in characteristics in 50 GHz over 1.5% of the bandwidth. Author

N72-20138 British Broadcasting Corp., Kingswood (England). Research Dept.
FIELD-STORE STANDARDS CONVERSION: COLOUR OPERATION OF THE MK.2B (C06/508) CONVERTER/SYNCHRONISER
D. W. Stebbings 1972 14 p refs
(BBC-1972/2; EL-60) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A description is given of the way in which color television signals are transcoded as part of the standards conversion process. The impairments of color performance brought about by the standards conversion process are also described, together with methods used to minimise their effects. Transcoding is not used when the equipment is working as a field-store synchroniser. The other color circuits which are used in this role are described. Author

N72-20139 British Broadcasting Corp., Kingswood (England). Research Dept.
INTERFERENCE CHARACTERISTICS OF DUAL-STANDARD MONOCHROME TELEVISION RECEIVERS OPERATING IN THE UHF BANDS
C. R. G. Reed Mar. 1972 20 p refs
(BBC-1972/4; RA-92) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The results are presented for a series of measurements made in 1970 on the interference rejection characteristics of six monochrome dual standard (Systems A and I) receivers. These receivers are operated in the UHF bands (Bands 4 and 5) using System I. Author

N72-20140* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSITION TRACKING BIT SYNCHRONIZATION SYSTEM Patent
Tage O. Anderson, William J. Hurd, and William C. Lindsey, inventors (to NASA) Issued 7 Dec. 1971 31 p Filed 8 Jul. 1969 Supersedes N70-11161 (08 - 01, p 0058) Sponsored by NASA
(NASA-Case-NPO-10844; US-Patent-3,626,298;
US-Patent-Appl-SN-839934; US-Patent-Class-325-321;
US-Patent-Class-178-69.5R; US-Patent-Class-179-15BS
US-Patent-Class-325-4; US-Patent-Class-325-38;
US-Patent-Class-325-58) Avail: US Patent Office CSCL 17B

A bit synchronization system is described, which incorporates a digital data transition tracking phase locked loop. The system, to which an input signal in the form of a noise-distorted constant amplitude bipolar stream of data bits is assumed to be supplied, includes two integration channels. In one channel integrations are performed over assumed bit times, each bit time being equal to a bit period, while in the other channel integrations are performed over integration windows, each window being less than a bit period. The outputs of the two channels are combined to provide a pair of binary signals which are supplied to a digital filter, comprising a variable length counter and a variable gain register. The contents of two registers are combined to provide an error signal indicative of the direction of the phase difference between periods of bits in the stream and the assumed bit times. Official Gazette of the U.S. Patent Office

N72-20141* National Aeronautics and Space Administration, Washington, D.C.
WAVEGUIDE MIXER Patent
Thomas E. Sullivan, inventor (to NASA) Issued 4 Jan. 1972 12 p Field 26 Jun. 1970 Supersedes N70-35436 (08 - 19, p 3497)
(NASA-Case-ERC-10179; US-Patent-3,633,110;
US-Patent-Appl-SN-50207; US-Patent-Class-325-445;
US-Patent-Class-329-161; US-Patent-Class-329-162;
US-Patent-Class-332-51W; US-Patent-Class-333-73W;
US-Patent-Class-343-772; US-Patent-Class-343-773;
US-Patent-Class-343-786) Avail: US Patent Office CSCL 17B

The microwave mixer is comprised of crossed waveguides and a crystal mixer. One of the waveguides has input horns at each end which are axially adjustable with respect to the ends of the waveguide. This axial adjustment varies the width of the gap between the horn and waveguide to tune the signal input from the horn to the mixer. Accordingly, the mixer may be tuned by adjusting the position of the input horns with respect to the input ports of the mixer.
Official Gazette of the U.S. Patent Office

N72-20142*# City Coll. Research Foundation, New York. Dept. of Electrical Engineering.
DELTA MODULATION Final Report, 1 Jan. - 31 Dec. 1971
Donald L. Schilling 31 Dec. 1971 171 p refs
(Grant NGR-33-013-063)
(NASA-CR-115460) Avail: NTIS CSCL 17B

The conclusions of the design research of the song adaptive delta modulator are presented for source encoding voice signals. The variation of output SNR vs input signal power/when 8, 9, and 10 bit internal arithmetic is employed. Voice intelligibility tapes to test the 10-bit system are used. An analysis of a delta modulator is also presented designed to minimize the in-band rms error. This is accomplished by frequency shaping the error signal in the modulator prior to hard limiting. The result is a significant increase in the output SNR measured after low pass filtering. Author

N72-20143# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL TELEMETRY
V. V. Parin, ed. 6 Mar. 1972 277 p refs Transl. into ENGLISH of the book "Biologicheskaya Telemetriya" Moscow, Med. Press, 1971 263 p
(JPRS-55354) Avail: NTIS

This document is devoted to one of the new fields of biomedical research, biotelemetry, which deals with the development of methods and devices permitting telemetric data to be obtained on various biological processes in an animate organism and its behavior. A study is made of the subject of

biotelemetry, and a classification of biotelemetric systems and criteria for evaluating them are presented. Various types of bioradiotelemetric systems and their application in the physiology of labor and sports, in clinical research (in particular, in gastroenterology), and in space biology and medicine are described. For individual titles, see N72-20144 through N72-20150.

N72-20144# Joint Publications Research Service, Arlington, Va.
BRIEF DISCUSSION OF GENERAL COMMUNICATIONS THEORY AND INFORMATION THEORY
Ye. S. Geller *In its* Biol. Telemetry 6 Mar. 1972 p 9-32 refs (See N72-20143 11-07)
Avail: NTIS

The history of the development of the communications theory and information theory is briefly reviewed along with the individuals most responsible for their development. Also discussed are the fundamentals of radio communications, wave propagation, wave lengths, and antenna types and operational characteristics. A.L.

N72-20145# Joint Publications Research Service, Arlington, Va.
STRUCTURE AND CLASSIFICATION OF BIOTELEMETRIC SYSTEMS
V. V. Parin, R. M. Rayevskiy, and Ye. S. Geller *In its* Biol. Telemetry 6 Mar. 1972 p 33-55 refs (See N72-20143 11-07)
Avail: NTIS

The structure of a biotelemetric system can be presented in accordance with the known block diagram of the communications channel proposed by Shannon in the form of five links: (1) the data source (sender); (2) the transmitter; (3) the communications channel; (4) the recipient; and (5) the recipient of the information (consumer). Each of the links is characterized by a number of parameters specific to the given type of biotelemetric system. Biotelemetric systems can be classified with respect to three basic criteria: (1) purpose; (2) mutual arrangement and mobility of the subject, the transmitter, and the receiver; and (3) technical characteristics. Biotelemetric systems can be further subdivided into three large groups: (1) systems for tracking and recording the movement of biological subjects; (2) systems for remote transmission of the physiological parameters of the examined objects; and (3) combined systems. A.L.

N72-20146# Joint Publications Research Service, Arlington, Va.
BIOTELEMETRIC SYSTEM ELEMENTS
R. M. Bayevskiy, Ye. S. Geller, and R. V. Unzhin *In its* Biol. Telemetry 6 Mar. 1972 p 56-106 refs (See N72-20143 11-07)
Avail: NTIS

The devices for gathering of biological information and its conversion to a form suitable for further amplification and transmission over a radio channel can be called bioinformation converters. The most important requirements of bioinformation converters are minimum distortion of the measured parameters and maximum noiseproofness. All measured medical-physiological parameters can be divided into two large groups: (1) measured directly, and (2) measured indirectly. Directly measured parameters include the biopotentials of the brain, body temperature, and the heart beat. Indirectly measured parameters include such things as saturation of the arterial blood with oxygen and impedance of the tissues. Physiological parameters most frequently measured by means of biotelemetry are briefly discussed along with descriptions and circuit diagrams of the various components of biotelemetric systems. A.L.

N72-20147# Joint Publications Research Service, Arlington, Va.
APPLICATION OF BIOTELEMETRY FOR RESEARCH IN THE PHYSIOLOGY OF LABOR AND SPORTS: EQUIPMENT FOR STUDYING FREELY MOVING PEOPLE c04
R. V. Unzhin and L. S. Dombrovskiy *In its* Biol. Telemetry 6 Mar. 1972 p 107-141 refs (See N72-20143 11-07)
Avail: NTIS

Specific types of biotelemetric equipment for observation of freely moving people are discussed. Descriptions and circuit diagrams are presented for the following instruments: (1) TEK-1 teleelectrocardiograph; (2) KRP combination telemetric devices; (3) REK-1 radiopulsophone-electrocardiograph; (4) MRP-1K10 multipurpose radiotelemetric devices; (5) multipurpose modular radiotelemetric system 3MMRS; (6) three channel biotelemetric system with tape recorder 3BTS-M; (7) eight channel biotelemetric system; and (8) close-range miniature telemetric devices for EMG transmissions. A.L.

N72-20148# Joint Publications Research Service, Arlington, Va.
APPLICATION OF BIOTELEMETRY IN PHYSIOLOGY OF LABOR AND SPORTS c04
V. V. Rozenblat and L. S. Dombrovskiy *In its* Biol. Telemetry 6 Mar. 1972 p 142-175 refs (See N72-20143 11-07)
Avail: NTIS

Biotelemetry in the physiology of labor is important because: (1) it can help provide a physiological basis for scientific organization of production; (2) studies of functional shifts give an idea not only of the nature of the work performed but also of the conditions of the production environment; and (3) physiological observations permit judgment of the nature of the course of certain pathological processes and deviations under the conditions of professional activity. In production physiological studies, just as in sports, dynamic systems are finding the greatest application. On the modern level of development of the physiology of sports and sports medicine the necessity for performing physiological examinations during the process of actual muscular activity of the sportsman is being felt more and more acutely. The physiology of sports can be considered one of the fields in which the telemetric procedure is especially necessary and has the broadest sphere of application. A.L.

N72-20149# Joint Publications Research Service, Arlington, Va.
SPACE BIOTELEMETRY
V. V. Parin and R. M. Bayevskiy *In its* Biol. Telemetry 6 Mar. 1972 p 176-212 refs (See N72-20143 11-07)
Avail: NTIS

One of the specific procedures of space biology is biological telemetry. This branch of medical radio electronics has been developed intensely in connection with progress in astronautics. Biotelemetry has a relation to all aspects of space biology: studying the effect of the factors of outer space on animate organisms; insuring flight safety; monitoring the conditions which astronauts must endure; and studying the forms of extraterrestrial life. Space biotelemetry deals with the problems of obtaining, converting, storing, and transmitting biological data under space flight conditions. This is one of the divisions of space biology which combines the achievements of medicine, physiology, radio engineering, electronics, automation, cybernetics, and other sciences. Space biotelemetry plays an important role in providing for prolonged and long-range manned space flights. A.L.

N72-20150# Joint Publications Research Service, Arlington, Va.
TELEMETRY IN GASTROENTEROLOGY
Ye. B. Babskiy *In its* Biol. Telemetry 6 Mar. 1972 p 213-266 refs (See N72-20143 11-07)
Avail: NTIS

Telemetry has acquired unique, effective and prospective application in experimental and clinical gastroenterology. The urgency of developing the new procedure arose from the fact that physiology and clinical medicine had at their disposal a relatively small number of methods of investigating the functions of the human alimentary canal. The principle of telemetric investigation of the state and activity of the stomach and intestines consists in having the man or animal swallow a miniature radio receiver which, on passing through the alimentary canal, continuously transmits data on defined physical and chemical process taking place in this organ wherever it is located at the given time. Thus, it is possible to use telemetry to obtain

a representation of the functional state of the digestive organs.
Author

N72-20151# Lockheed Missiles and Space Co., Palo Alto, Calif.
CHARACTERISTICS OF RADAR TARGETS
V. V. Grigorin-Riabov, ed. [1970] 27 p ref Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 40-80
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The fundamental properties and classification of objects considered as radar targets are discussed. Elementary targets, target trajectories and their influence on radar parameters, and target amplitude fluctuations are considered. The properties of signals reflected from distributed targets, radar cross section of surface targets, and effective radar cross section of volume targets were also investigated.
K.P.D.

N72-20152# Royal Aircraft Establishment, Farnborough (England).
UTILISATION OF SIMPLE OMNIDIRECTIONAL VHF ANTENNAE ON BOARD SHIPS FOR SATELLITE RECEPTION, ELIMINATING THE MULTI-PATH EFFECTS THROUGH A DIVERSITY SYSTEM
W. Goebel Nov. 1971 73 p refs Transl. into ENGLISH from "Verwendung Einfacher Omidirektionaler Ukw-antennen auf Schiffen fuer den Satellitenempfang unter Ausschaltung des Mehrwegeeffekts Mittels Fines Diversity-Systems", Deutsche Luft-und Raumfahrt report FB-71-05
(RAE-Lib-Trans-1619; BR-28207; FB-71-05) Avail: NTIS

The mathematical interrelationship of multipath effects is demonstrated. This knowledge allows a very simple configuration of omnidirectional antennas for fading avoidance by antenna diversity. By inclusion of the reflected beam, the limit of usable elevation angles for satellite reception, normally regarded to be 10 deg, can be reduced down to the Brewster angle (VHF: 3 deg). Futhermore, margins against multipath fading may be omitted. However, a satellite with a circularly polarized antenna must be assumed. Improved distance measurements according to tone-ranging methods are described. An accuracy of position finding (1 sigma deviation) of 1-2 nautical miles seems to be attainable, even though ionospheric distance errors exist. Conditions under which satellite and terrestrial communications may exist within the same frequency band without mutual interference are discussed.
Author

N72-20153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COLLAPSIBLE STRUCTURE FOR AN ANTENNA REFLECTOR Patent Application
Marc R. Trubert, inventor (to NASA) Filed 26 Oct. 1971 30 p
(Contract NAS7-100)
(NASA-Case-NPO-11751; NASA-Case-NPO-11752; US-Patent-Appl-SN-192141) Avail: NTIS CSCL 17B

A collapsible support is described for an antenna reflector suited for use in supporting antennas aboard space vehicles. The support is characterized by a rigid base, a number of struts pivotally coupled with the base at their base ends, and supported for simultaneous pivotal displacement from a first rest position wherein they are arranged in substantial parallelism to a second rest position wherein they are arranged in a substantially diverging relationship. An endless band, coupled with the distal ends of the struts, is supported in a flexible, serpentine configuration when the struts are in the first rest position and in a rigid annular configuration when the struts are in the second rest position.
NASA

N72-20154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA COMPRESSION SYSTEM Patent Application
Robert F. Rice, inventor (to NASA) Filed 3 Sep. 1971 23 p
(Contract NAS7-100)
(NASA-Case-NPO-11243; US-Patent-Appl-SN-177753) Avail: NTIS CSCL 09F

A data compression system is described in which TV PCM data for each line scan is received in the form of a succession of multibit pixel words. All or selected bits of each word are compressed by providing difference values between successive pixel words and coding the difference values of a selected number of pixel words forming a block into a fundamental sequence (FS). The FS, based on its length and the number of words per block, is either transmitted as the compressed data or is used to generate a code FS or its complement is used to generate a code FS bar. When the code FS is generated, its length is compared with the original block PCM and only if the former is the shorter of the two is the code transmitted. Selected bits per pixel word may be compressed, while the remaining bits may be transmitted directly, or some of them may be omitted altogether.
NASA

N72-20155*# Philco-Ford Corp., Philadelphia, Pa.
SATELLITE COMPOSITE ANTENNA FEED SUBSYSTEM Patent Application
Vito Joseph Jakstys, inventor (to NASA) Filed 21 Sep. 1971 15 p Prepared for Fairchild Hiller, Germantown, Md.
(Contracts NAS5-11609; SC-68-4)
(NASA-Case-GSC-11046-1; US-Patent-Appl-SN-182399) Avail: NTIS CSCL 17B

A composite antenna feed subsystem is described which is concentrated at the prime focus of a satellite parabolic reflector, and which accommodates a number of frequency bands. The arrays comprising the subsystem are mounted on the top cover of a communication module. A multimode horn is arranged at the center of the subsystem axis which functions at X- and C-band frequencies. A cross-array consisting of individual elements form the S-band feed, with one arm of the S-band array containing an element mutually shared with the L-band array. Provision is also made for UHF frequencies, and a dipole arrangement for VHF frequencies is arranged around the S-band arms.
NASA

N72-20156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATIC CARRIER ACQUISITION SYSTEM Patent Application
Robert C. Bunce, inventor (to NASA) Filed 13 Dec. 1971 15 p
(Contract NAS7-100)
(NASA-Case-NPO-11628; US-Patent-Appl-SN-207211) Avail: NTIS CSCL 17B

An automatic carrier acquisition system for a phase locked loop receiver is described. It includes a local oscillator, which sweeps the receiver to tune across the carrier frequency uncertainty range until the carrier crosses the receiver IF reference. It includes a pair of multipliers which multiply the IF signal with the IF reference in phase and in quadrature. The outputs of the multipliers are filtered through bandpass filters and power detected. The output of the power detector has a signal dc component which is optimized with respect to the noise dc level by the selection of the time constants of the filters as a function of the sweep rate of the local oscillator.
NASA

N72-20157*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MULTIFUNCTION AUDIO DIGITIZER Patent Application
Leo G. Monford, Jr., inventor (to NASA) Filed 9 Nov. 1971 12 p
(NASA-Case-MSC-13855-1; US-Patent-Appl-SN-196931) Avail: NTIS CSCL 17B

An apparatus is described which simultaneously produces both direct delta modulation and pulse code modulation. An input signal, after amplification, is supplied to a window comparator which supplies a polarity control signal to gate the output of a clock to the appropriate input of a binary up-down counter, depending on whether the slope of the input signal is

positive or negative. The control signals provide direct delta modulation, while the up-down counter output provides pulse code modulation. NASA

N72-20158*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIPLE REFLECTION CONICAL MICROWAVE ANTENNA Patent Application
Robert E. Oliver, inventor (to NASA) Filed 22 Nov. 1971 19 p
(Contract NAS7-100)
(NASA-Case-NPO-11661; US-Patent-Appl-SN-200682) Avail: NTIS CSCL 17B

Microwave antennas employing a conical reflector are described, having one or two subreflectors to reflect radiation from a point source feed element. A plane wave front emerges through the antenna aperture with a minimum of blockage of the aperture area by the subreflector(s), with virtually no reflection of radiation back into the feed element. NASA

N72-20159*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TIME SYNCHRONIZED VLF PHASE TRACKING RECEIVER SYSTEM Patent Application
Samuel C. Ward, inventor (to NASA) Filed 19 Aug. 1971 13 p
(Contract NAS7-100)
(NASA-Case-NPO-11600; US-Patent-Appl-SN-173052) Avail: NTIS CSCL 17B

A very low frequency phase tracking receiver system is described which was adapted to have a time-keyed mode of operation. The system is time-keyed in accordance with a time code to effect an improved signal to noise ratio. The system is tuned to receive one frequency of primary standard signals. The frequency is characterized by a three-frequency format transmitted by the National Bureau of Standards radio station WWVL. The system is keyed to have the automatic gain control circuit of the receiver clamped, and the system antenna effectively disabled, during time periods when the selected frequency signal is not being received. NASA

N72-20160# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
CALCULATION AND MEASUREMENT OF ELECTROMAGNETIC FIELDS AT WAVE GUIDE DISCONTINUITIES WITH THIN IRISES
F. Schlude 1971 109 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-95) Avail: NTIS; DFVLR Porz-Wahn: 29,10 DM

The waveguide step with iris and the discontinuity between an array of similar waveguides and one large guide were studied using a generalized field expansion method. This is derived from the usual integral equation method of diffraction theory. Results are presented for several kinds of steps. The measurements of fields after an array discontinuity without step show good agreement between theory and experiment. For box horns fed by such steps, an approximate theory for pattern calculation is given. The theoretical results obtained by this method agree well with the measurements. Author

N72-20161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODE REGENERATIVE CLEAN-UP LOOP TRANSPONDER FOR A MU-TYPE RANGING SYSTEM Patent Application
William J. Hurd, inventor (to NASA) Filed 8 Nov. 1971 23 p
(Contract NAS7-100)
(NASA-Case-NPO-11707; US-Patent-Appl-SN-196399) Avail: NTIS CSCL 17B

A loop transponder is described for regenerating the code of a mu-type ranging system. It includes a phase locked loop, a code generator, and a loop detector. The function of the phase locked loop is to provide phase lock between a received component of the range signal and a replica of the received component, provided by the code generator. Author

N72-20162*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RECEIVER WITH AN IMPROVED PHASE LOCK LOOP IN A MULTICHANNEL TELEMETRY SYSTEM WITH SUPPRESSED CARRIER Patent Application
Stanley Butman and Uzi Timor, inventors (to NASA) Filed 18 Aug. 1971 20 p
(Contract NAS7-100)
(NASA-Case-NPO-11593; US-Patent-Appl-SN-172807) Avail: NTIS CSCL 09F

A phase locked loop is described for a receiver in a two-channel PSK/PM telemetry system with a suppressed carrier. The receiver inphase channel output is filtered by first and second bandpass filters, and the receiver quadrature channel output is filtered by third and fourth bandpass filters. The outputs of the first and third filters are mixed in one mixer and the outputs of the second and fourth filters are mixed in another. The outputs of the two mixers are weighted to produce a weighted sum signal which is supplied to the loop filter. NASA

N72-20163*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EMERGENCY LUNAR COMMUNICATIONS SYSTEM Patent Application
Otha H. Vaughan, Jr. and Lee B. Malone, Jr., inventors (to NASA) Filed 3 Nov. 1970 15 p
(NASA-Case-MFS-21042; US-Patent-Appl-SN-86417) Avail: NTIS CSCL 17B

A communication system is described for emergency use on the moon that includes three transceivers. One of the transceivers is carried by an astronaut and another is positioned at a base camp. The system also includes a hand-held launcher and rocket vehicle that is utilized by the astronaut to launch a third relay transceiver in an upward trajectory above the lunar surface. The relay transceiver is mounted in the rocket vehicle and relays voice communications between the two transceivers located on the lunar surface. NASA

N72-20164# *Transportation Systems Center, Cambridge, Mass.*
TIME/FREQUENCY SYSTEMS
E. H. Farr, L. A. Frasco, H. D. Goldfein, and R. M. Snow Jun. 1971 87 p refs
(DOT-TSC-FAA-71-17) Avail: NTIS

The evaluation and analysis of the technological risk areas are emphasized. The technical risk areas include the effects of multipath on signalling over radio links. Material is presented which bears on the comparative analysis of T/F with alternative technologies, including satellite and beacon-based system concepts. It is concluded that the most critical problem areas requiring further study are (1) multipath effects on T/F systems, and (2) systems operability under nonideal conditions leading to degradability. Author

N72-20165# Transportation Systems Center, Cambridge, Mass.
MONOPULSE AZIMUTH MEASUREMENT IN THE ATC RADAR BEACON SYSTEM
Bernard Kulke, Bruce Rubinger, and George G. Haroules Dec. 1971 133 p refs
(DOT-TSC-FAA-72-6) Avail: NTIS

A review is made of the application of sum-difference beam techniques to the ATC radar beacon system. A detailed error analysis is presented for the case of a monopulse azimuth measurement based on the existing beacon antenna with a modified feed network. Without beam sharpening, single reply monopulse accuracy is less than that of the existing system. With beam sharpening and/or by using multiple reply information, the azimuth error is estimated to be as little as 1 or 2 azimuth change pulses, compared to 3 for the common digitizer. Monopulse modification implies a considerable increase in

system cost and complexity. A monopulse modification for azimuth measurement in the radar beacon system studied is not recommended. Author

N72-20166# Bochum Univ. (West Germany). Abteilung fuer Elektrotechnik.
MEASUREMENT OF THE TENSOR PERMEABILITIES OF FERRITE BARS IN CIRCULAR WAVEGUIDES Ph.D. Thesis [MESSUNG DES PERMEABILITAETSTENSORS VON FERRITEN AN STAEBEN IN DER RUNDHOHLEITUNG]
Helmut Entschladen 12 Feb. 1971 100 p refs In GERMAN
Avail: NTIS

A method for determining the eigenvalues of the permeability tensors of magnetic ferrite from the propagation constant of waves in a suitable tubular waveguide was developed. With the aid of results for wave propagation in a continuously expanding magnetic ferrite medium, as well as known approximate solutions for the wave propagation in tubular waveguides, the properties of a circular waveguide with an axially mounted, longitudinal, magnetic ferrite bar are determined. The measurement of the propagation constants was made with magnesium-manganese ferrite rods with one to three millimeter diameter as a function of the magnetic field strength from zero to 3900 Oersteds.
Transl. by P.N.F.

N72-20167*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SYSTEM FOR IMPROVING SIGNAL-TO-NOISE RATIO OF A COMMUNICATION SIGNAL Patent Application
George D. Arndt, inventor (to NASA) Filed 7 Aug. 1970 16 p
(NASA-Case-MSC-12259-2; US-Patent-Appl-SN-61895) Avail: NTIS CSCL 17B

A superconductive resonant cavity is energized with radio frequency energy. The cavity includes a tuning stub having a piece of semiconductor material mounted on the end. An incoming communication signal modulates a light source which is optically coupled to the semiconductor by a fiber optic bundle. This varies the dielectric constant of the semiconductor which, in turn, varies the resonant frequency of the cavity. An angle modulation demodulator senses the frequency of the radio frequency oscillations in the cavity and produces a replica of the communication signal with improved signal to noise ratio.
NASA

N72-20168*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
COLLAPSIBLE HIGH GAIN ANTENNA Patent Application
Herbert E. Cribb, inventor (to NASA) Filed 16 Sep. 1971 12 p
(NASA-Case-KSC-10392; US-Patent-Appl-SN-181024) Avail: NTIS CSCL 17B

A lightweight, small, high gain antenna is described which is capable of being packaged in a collapsed form and automatically expanded when in use. The antenna includes a cylindrical housing having a rod with a piston adjacent one end extending therethrough. Attached to the outer end of the rod in a normally collapsed state is a helical wire coil. When the gas producing means is activated the piston and rod are shifted outwardly to expand the wire coil. A latch means is provided for holding the helical coil in the expanded position. NASA

N72-20169# National Bureau of Standards, Washington, D.C. Mechanics Div.
MAGNETIC RECORDING OF ACOUSTIC DATA ON AUDIOFREQUENCY TAPE
Edwin D. Burnett, Edith L. R. Corliss, and Raymond D. Berendt Apr. 1972 36 p refs
(NBS-TN-718) Avail: SOD $0.40 as C 13.46:718

Application of magnetic tape recording to storage and analysis of data obtained from acoustic measurements is discussed. In general, the most suitable machines are those designed primarily for recording studios. Advantages in signal to noise ratios and extended linear range can be realized by careful choice of recording medium, adjustment of the equipment to optimum performance, and proper care in monitoring the recording process. General instructions for realizing these advantages are given. Particular emphasis is given to the procedures for making well calibrated recordings in the field, for analysis of noise problems. Author

N72-20170# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
LASER TRANSMISSION SYSTEMS AND MODULATION METHODS [LASER-UEBERTRAGUNGSSYSTEME UND -MODULATIONSVERFAHREN]
A. Sander Sep. 1971 336 p refs In GERMAN
(FTZ-A-465-TBR-5) Avail: NTIS HC $6.00 / MF $0.95

A survey is given of the applications of lasers to telecommunication systems, with emphasis on the modulation methods used. The simplest systems use intensity modulation, straightforward reception, luminescent or laser diodes as radiation sources and silicon avalanche photodiodes as detectors. More complicated and powerful laser links use pulse code modulation, especially pulse code intensity modulation and delta modulation. Several applications are summarized, including glass fiber cables for television transmission. ESRO

N72-20171# Naval Electronics Lab. Center, San Diego, Calif.
DISTRIBUTION FREE DETECTION OF COMMUNICATION SIGNALS Research and Development Report, May - Jul. 1971
G. M. Dillard 2 Sep. 1971 25 p refs
(Proj. ZFXX-212-001/NELC-Z222/)
(AD-734662; NELC-TR-1776) Avail: NTIS CSCL 09/4

The report concludes that distribution-free (DF) methods of signal detection can provide a constant false-alarm rate for communications systems. It describes two DF methods which can easily be implemented and analyzed. DF methods are shown to require only slightly higher signal levels (approximately 2-dB SNR) than optimum procedures for which it is assumed that the probability distribution of the data is known.
Author (GRA)

N72-20172# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
MEASUREMENT OF ELECTROMAGNETIC RADIATION LEVELS FROM SELECTED TRANSMITTERS OPERATING BETWEEN 54 AND 220 MHZ IN THE LAS VEGAS, NEVADA, AREA
Kenneth R. Envall and Richard W. Peterson Sep. 1971 71 p refs
(PB-203999; BRH/DEP-72-4; FDA72-8012) Avail: NTIS; GPO HC $0.75 as He20.4110:72-4 CSCL 20N

Electromagnetic power levels were measured and compared with theoretical power levels from selected transmitters operating in the frequency range of 54 to 220 MHz in the Las Vegas, Nevada, area. The field measurements were made at 62 grid locations by means of calibrated dipole and biconical antennas. Power variations with respect to antenna height, time of day, distance from a grid point, angular dependence, and terrain were investigated. The data were evaluated in terms of observed and theoretical power levels and converted to power densities for hazards analysis applications. The results indicate that estimates of theoretical power levels should serve as a satisfactory measure of population exposure to electromagnetic energy inn the frequency range considered. Author (GRA)

N72-20173# Technology Service Corp., Santa Monica, Calif.
SYNTHESIS OF HIGH RESOLUTION RADAR SYSTEMS FOR DISPLAY SIMULATION AND TRAINING Final Report, May 1970 - Mar. 1971
R. L. Mitchell, A. B. Lucero, R. E. Harrison, and D. J. Arnold Wright-Patterson AFB, Ohio AF Human Resources Lab. Jun. 1971 85 p refs

(Contract F33615-70-C-1610; AF Proj. 6114)
(AD-734548; TSC-PD-064-18; AFHRL-TR-71-11) Avail: NTIS CSCL 17/9

A comprehensive analysis was conducted of the theory and practice of utilizing digital techniques for simulating high-resolution radar systems. The objective was to simulate radar displays of cultural complexes for navigation training. Three major phases of this effort are: (1) develop tractable scattering models, (2) construct a data base, and (3) define a simulation procedure that is computationally efficient. The techniques developed in this report are generally applicable for any radar or processor, whether of brute-force type or synthetic aperature. To validate the approach, a 30 city-block area is incorporated into a digital data base by using photogrammetric techniques on aerial photography. From this data base, a radar display is simulated that is in good agreement with actual radar imagery. The practicality of a real-time digital simulation is demonstrated.

Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-20174 National Lending Library for Science and Technology, Boston Spa (England).
EDF AUTOMATIC DATA PROCESSING SYSTEMS IN NATIONAL AND REGIONAL CONTROL CENTERS
V. Saminaden and J. Goyer [1971] 10 p ref Transl. into ENGLISH from Rev. Gen. Elec. (Paris), v. 80, no. 5, May 1971 p 380-382
(NLL-CE-Trans-5807-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A description is given of the computer and equipment configurations used at the National and Regional Control Centers of France. The system is used to forecast and control energy transfer systems. One of the main characteristics of the system is that it integrates the acquisition and selective presentation of data with long or short term forecasting studies. The complete equipment thus provides the possibility of logical sequencing of the various programs both at the National Center and in the Regions.

Author

N72-20175 National Lending Library for Science and Technology, Boston Spa (England).
GENERAL DESCRIPTION OF THE COMPUTER PROGRAMS USED BY THE EdF NATIONAL CONTROL CENTER
D. Boulle and M. Vincent [1971] 24 p ref Transl. into ENGLISH from Rev. Gen. Elec. (France), v. 80, no. 5, May 1971 p 383-392
(NLL-CE-Trans-5808-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Computer programs designed to help forecast reliability of supply, quality of service, and economy of operation for hydroelectric power plants, are described. Descriptions of computation methods at various forecasting stages-long term control, weekly forecasting, and daily forecasting are given.

Author

N72-20176* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL QUASI-EXPONENTIAL FUNCTION GENERATOR Patent
Tage O. Anderson and William J. Hurd, inventors (to NASA) Issued 4 Jan. 1972 8 p Filed 14 May 1970 Sponsored by NASA
(NASA-Case-NPO-11130; US-Patent-3,632,996;
US-Patent-Appl-SN-21508; US-Patent-Class-235-92DE;
US-Patent-Class-235-92R; US-Patent-Class-235-92CC;
US-Patent-Class-235-92DM; US-Patent-Class-235-92LG;
US-Patent-Class-340-347DA; US-Patent-Class-340-347DD;
US-Patent-Class-235-152) Avail: US Patent Office CSCL 09B

A quasi-exponential function generator is described which is comprised of a multistage counter, clocked at a rate which is a function of the count or value of the counter. The possible counts are divided into fields which are sensed and the clock rate is reduced by a factor of two, as the count changes from one field to a lower field. Each field is further divided into several subfields which are also detected to control the clock rate to vary from subfield to subfield.

Official Gazette of the U.S. Patent Office

N72-20177* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD AND APPARATUS FOR HIGH RESOLUTION SPECTRAL ANALYSIS Patent
Willard F. Gillmore, inventor (to NASA) Issued 28 Dec. 1971 30 p Filed 13 Aug. 1970 Supersedes N71-33321 (09 - 20, p 3273) Sponsored by NASA
(NASA-Case-NPO-10748; US-Patent-3,631,339;
US-Patent-Appl-SN-63383; US-Patent-Class-324-77G) Avail: US Patent Office CSCL 09B

A method and apparatus are described for high resolution power spectral analysis. A digital computer is employed without stringent stability requirements on the sampling rate and using a pair of balanced mixers to combine one signal directly and in quadrature with a second signal, alternately sampling the outputs of the mixers through an analog to digital converter. The computer computes a convolution spectrum from two autocorrelation and two cross correlation functions. These can be obtained from two sequences of samples with compensation for variations in gain of the signal channels by normalizing correlation functions, and known deviation from -90 deg in the quadrature mixing of signals by using phi in place of -90 deg in the analysis and dividing the sum of the cross correlation functions by -sin phi.

Official Gazette of the U.S. Patent Office

N72-20178*# Radio Corp. of America, Van Nuys, Calif. Electromagnetic and Aviation Systems Div.
DESIGN, DEVELOPMENT, FABRICATION AND DELIVERY OF REGISTER AND MULTIPLEXER UNITS Final Report
A. Feller and T. Lombardi Dec. 1971 51 p refs
(Contract NAS8-25582)
(NASA-CR-123562) Avail: NTIS CSCL 09B

Two complementary MOS monolithic chip types were developed, which contain a register and multiplexer unit to be used in the central processing unit of a digital computer. The partition of the logic into a chip size consistent with the characteristics of the packages is discussed. The logic was implemented by specially configured circuitry designed to layout, as well as to optimize, performance by taking advantage of the properties of CMOS logic. Of several approaches considered for generating LSI CMOS arrays, the CMOS standard cell array design technique was selected. These design automation techniques were used to generate the chip layout, art work and working master plates, followed by the fabrication and testing of the two chip types. Sixty functional LSI arrays were delivered.

Author

N72-20179*# Computer Sciences Corp., Huntsville, Ala. Aerospace Systems Center.
FUNCTIONAL REQUIREMENTS FOR DESIGN OF THE SPACE ULTRARELIABLE MODULAR COMPUTER (SUMC) SYSTEM SIMULATOR Interim Report
R. T. Curran and W. A. Hornfeck Feb. 1972 43 p refs
(Contract NAS8-26698)
(NASA-CR-123574) Avail: NTIS CSCL 09B

The functional requirements for the design of an interpretive simulator for the space ultrareliable modular computer (SUMC) are presented. A review of applicable existing computer simulations is included along with constraints on the SUMC simulator functional design. Input requirements, output requirements, and language requirements for the simulator are discussed in terms of a SUMC configuration which may vary according to the application.

Author

N72-20180*# Radio Corp. of America, Somerville, N.J. Solid State Div.
MONOLITHIC PARALLEL PROCESSOR, PHASE 1A Final Progress Report, 28 Jan. 1970 - 27 Sep. 1971
27 Sep. 1971 38 p refs
(Contract NAS5-11577)
(NASA-CR-122372) Avail: NTIS CSCL 09B

A four-bit parallel processor LSI array was designed and fabricated using COS/MOS integrated-circuit technology. The design features include the provision for interconnecting groups of parallel-processor chips to form an expanded processor of any desired word length. This 800-transistor 'computer on a chip' circuit has the logic capability of a medium-size, medium-speed, general-purpose computer suitable for sophisticated scientific data processing. The ability to fabricate this device repetitively was demonstrated. Author

N72-20181*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LINEAR INTERPOLATION OF FOUR-DIMENSIONAL TABULATED DATA FOR COMPUTERS WITH SINGLE SUBSCRIPTED VARIABLE CAPABILITY
William R. Farr 19 Nov. 1971 24 p refs
(NASA-TM-X-64640) Avail: NTIS CSCL 09B

Using only a one-dimensional subscripted variable, a FORTRAN computer subprogram was developed to linearly interpolate tabulated data of functions of four or less variables. The primary motivation was for faster computation. Author

N72-20182*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERACTIVE GRAPHICS SYSTEM FOR IBM 1800 COMPUTER
T. P. Carleton, D. R. Howell, and W. H. Mish Mar. 1972 55 p refs Submitted for publication
(NASA-TM-X-65859; X-692-72-92) Avail: NTIS CSCL 09B

A FORTRAN compatible software system that has been developed to provide an interactive graphics capability for the IBM 1800 computer is described. The interactive graphics hardware consists of a Hewlett-Packard 1300A cathode ray tube, Sanders photopen, digital to analog converters, pulse counter, and necessary interface. The hardware is available from IBM as several related RPQ's. The software developed permits the application programmer to use IBM 1800 FORTRAN to develop a display on the cathode ray tube which consists of one or more independent units called pictures. The software permits a great deal of flexibility in the manipulation of these pictures and allows the programmer to use the photopen to interact with the displayed data and make decisions based on information returned by the photopen. Author

N72-20183# RAND Corp., Santa Monica, Calif.
QUESTIONNAIRE: MODELS, COMPUTER MACHINE SIMULATIONS, GAMES AND STUDIES
Martin Shubik and Garry Brewer Jul. 1971 81 p
(P-4672) Avail: NTIS

This questionnaire is to aid the interested professional in describing, characterizing, and analyzing his game, model, or simulation. It is a first and, hopefully, useful step in the clarification of professional standards in the work on gaming and simulation. Futhermore, the questionnaire is designed so that it might also serve as a device for communicating and cataloging different games and simulations in a format that encourages easy interchange of information. The questionnaire format has been adopted for three purposes. (1) In the course of ongoing investigations this document will be used as a questionnaire. (2) Stress in design has been to produce a categorization scheme for the description and classification of games and simulation in general. (3) The belief that the compiling of a large, consistent sample of many games and simulations for the purposes of analysis, evaluation, information interchange, and the construction of professional standards was overdue. Author

N72-20184# RAND Corp., Santa Monica, Calif.
AN OVERVIEW OF THE ISPL COMPUTER SYSTEM DESIGN
R. M. Balzer Nov. 1971 19 p refs Presented at 3d Operating Sys. Conf., Palo Alto Calif., 18-20 Oct. 1971
(P-4734) Avail: NTIS

The ISPL (incremental system programming language) design for software research is considered. The topics discussed include the machine instruction set, addressing structure, communication mechanism, maintenance and scheduling, and debugging. The system approach involves simplified incremental compilation and addressing; centralization of communication mechanisms, leading to the construction of hierarachical subsystems; and the separation of maintenance from scheduling through an expanded machine structure. K.P.D.

N72-20185# RAND Corp., Santa Monica, Calif.
A TREE GRAPHER FOR THE LINGUIST
Richard L. Bisbey Nov. 1971 23 p refs Presented at 10th Ann. UAIDE Conf. on Computer Graphics, Los Angeles, 25-28 Oct. 1971
(P-4730) Avail: NTIS

A general purpose program is described which is used in the MIND (management of information through natural discourse) system for graphically displaying finite trees. The program is based on a simple recursive algorithm which generates the display using a single determinsitic walk of a tree which is stored in binary representation. Modifications are discussed which allow the program to draw infinite trees and arbitrary nets. Author

N72-20186# Technische Univ., Berlin (West Germany).
ON LIMITED ASSEMBLY LANGUAGES AS FINAL LANGUAGES IN ALGOL 60-TRANSLATION Ph.D. Thesis [UEBER GEEIGNETE ASSEMBLERSPRACHEN ALS ZIELSPRACHEN BEIDER ALGOL 60 - UEBERSETZUNG]
Guenter Wiesner 22 Feb. 1970 106 p refs In GERMAN
Avail: NTIS

A preliminary ALGOL to POESIA translation for the Siemens 2002 computer is developed that allows for a compromise between complete preservation of synactic ALGOL elements and their extensive decomposition into single operations.
Transl. by G.G.

N72-20187# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany).
THE MECHANICAL TRANSPORT BEHAVIOR OF MAGNETIC TAPES ON DIGITAL MAGNETIC TAPE STORAGE UNITS Ph.D. Thesis [DAS MECHANISCHE LAUFVERHALTEN VON MAGNETBAENDERN AUF MAGNETBAND-DIGITAL-SPEICHERN (MDS)]
Wolfgang Fell 1971 78 p refs In GERMAN
Avail: NTIS

The development and characteristics of magnetic tape recorders and digital magnetic tape storage equipment are discussed. Specific applications of the equipment with allowances for certain peculiarities in performance are described. Mathematical models are provided to explain the theories of magnetic tape recording. The mechanical devices used in various types of magnetic recorders are illustrated. Transl. by P.N.F.

N72-20188*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF RECURSIVE DIGITAL FILTERS HAVING SPECIFIED PHASE AND MAGNITUDE CHARACTERISTICS
Robert E. King and Gregory W. Condon Washington Apr. 1972 41 p refs
(NASA-TN-D-6709; L-8162) Avail: NTIS CSCL 09B

A method for a computer-aided design of a class of optimum filters, having specifications in the frequency domain of both magnitude and phase, is described. The method, an extension to the work of Steiglitz, uses the Fletcher-Powell algorithm to minimize a weighted squared magnitude and phase

criterion. Results using the algorithm for the design of filters having specified phase as well as specified magnitude and phase compromise are presented. Author

N72-20189# Transportation Systems Center, Cambridge, Mass.
A SURVEY TO DETERMINE FLIGHT PLAN DATA AND FLIGHT SCHEDULING ACCURACY
John R. Coonan Jan. 1972 121 p
(DOT-TSC-FAA-72-10) Avail: NTIS

Operational Flight Plan Data and Flight scheduling accuracy vs. published schedules and/or stored flight plan data are discussed. This accuracy was determined by sampling tracer flights of varying lengths, selected terminals, and high altitude sectors; then comparing this data with stored computer data, thus, revealing average delay areas. This information will aid operational analysts and programmers to construct flow control software programs. Author

N72-20190# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADAR OUTPUT UNITS CONNECTED TO ELECTRONIC DIGITAL COMPUTERS, CHAPTER 11
V. V. Grigorin-Riabov, ed. 1970 8 p refs Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 295-306
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Radar output units perform as the function of a pulse train integrator and threshold unit. The signals are integrated in the preselector with less losses, and the code conversion is accompanied by less errors and losses in resolution than in measurement, using markers on a display screen. Preliminary signal selection, conversion of range and angular coordinates into a bindary code, and the influence of instrumental data survey apparatus on radar range, accuracy, and resolution are also reviewed. J.A.M.

N72-20191# Aeronautical Research Labs., Melbourne (Australia).
SERIAL DIGITAL DATA GENERATOR
K. F. Fraser and U. R. Krieser Jul. 1971 22 p refs
(ARL/MF-327) Avail: NTIS

A serial digital data generator is described which provides signals of standard word composition for checking ground station digital interface equipment. Data recorded in special serial format on magnetic tape, are converted by the interface equipment to a form which is conveniently read using a digital computer.
Author

N72-20192# Technische Hochschule, Darmstadt (West Germany). Fakultaet fuer Mathematik und Physik.
THE THREE-DIMENSIONAL TRANSPORT PROBLEM OF LINEAR PROGRAMMING: CHARACTERISTICS AND SOLUTION Ph.D. Thesis [DAS DREIDIMENSIONALE TRANSPORTPROBLEM DER LINEAREN PLANUNGSRECHNUNG-EIGENSCHAFTEN UND LOESUNG]
Ulrich Barth 15 Jul. 1971 174 p refs In GEORGIAN
Avail: NTIS

A decomposition equation for the solution of the three dimensional transport problem is presented. The equation is based on the Williams decomposition equation for the two dimensional transport problem. The equation is applied in the solution of an axial problem and leads to a general problem in linear programming. The computer programs for solving the equations are described. Mathematical models of the operations involved are included. Transl. by P.N.F.

N72-20193# Lyon Univ. (France). Inst. de Physique Nucleaire.
DEVELOPMENT OF A MEANS OF DIALOGUE IN ACQUIRING DATA AT THE LEVEL OF A DISPLAY UNIT Ph.D. Thesis
Jean-Louis Cheval May 1971 72 p refs In FRENCH
(LYCEN-7121) Avail: AEC Depository Libraries

The system presented permits two important operations to be performed at the level of the display console: the designation of the spots (spectra channel), and the tracing of a curve. Once these operations are performed, the system can be adapted to meet the particular needs of the physicist. Some prehandling functions are given as examples. Some interesting extensions of the system exist. These extensions have the advantage of facilitating the interpretation on the screen, and of possessing a certain flexibility of operation, readily demonstrated using a photosensitive pencil. The data support (histograms) remain unchanged. The limits of the system are indicated. The display system is not sufficiently powerful to enable all the possible images to be presented. The regeneration rate imposes a maximum spot density, not to be exceeded. For example, the MENU displayed must be decomposed into several separately presented menus; the axes are eliminated, and the results are displayed in the most simple manner possible. NSA

N72-20194# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTER PROCESSING RADIOGRAPHIC IMAGES WITH THE FINITE FOURIER TRANSFORM
M. P. Ekstrom and O. L. Rater 14 Oct. 1971 17 p refs Presented at Nucl. Sci. Symp., San Francisco, 3 Nov. 1971 Sponsored by AEC
(UCRL-73484; Conf-711111-11) Avail: NTIS

The optimal design and implementation of two-dimensional, nonrecursive digital filters for use in the processing of radiographic images are considered. A stochastic system model is used for the image-forming process, and the filter is designed to a mean-square error criterion. Both the design algorithm and filter realization are mechanized by using a fast Fourier transform code, thereby ensuring the computational efficiency of the method. Author (NSA)

N72-20195# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires
ACCESSIBILITY OF EXACT NONLINEAR STATIONARY STATES IN WATER-BAG MODEL COMPUTER EXPERIMENTS
U. Finzi Jun. 1971 23 p refs
(EUR-CEA-FC-606) Avail: AEC Depository Libraries

The Bernstein, Greene, and Kruskal stationary states of a four-contour water bag system are discussed in detail. The time evolution of a linearly stable two-stream towards an exact nonlinear stationary state is shown to take place in computer experiments when suitable initial conditions are adopted. A method for the excitation of pure modes in a uniform water bag system is presented. NSA

N72-20196# Technische Hochschule Stuttgart (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
APPLICATION OF INTERACTIVE COMPUTER GRAPHICS TO THE CALCULATION OF AIRCRAFT STRUCTURES [DIE ANWENDUNG VON INTERAKTIVER COMPUTERGRAPHIK BEI DER BERECHNUNG VON TRAGWERKEN]
J. H. Argyris and I. Grieger Cologn DGLR 1971 36 p refs In GERMAN Presented at the 4th DGLR Annual meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The effective use of display devices for a man-machine dialog requires that both man and the computer should have the possibility to generate and to modify graphic and alphanumerical data. This concept of interactive computer graphics is discussed and applied to the computations of structures. The ASKA program for automatic analysis of dynamic systems using the finite element method and its complement the INGA program for interactive graphic analysis are presented and discussed. ESRO

N72-20197# Karlsruhe Univ. (West Germany).
INVESTIGATIONS OF THE PICTURE ANALYSIS SYMBOLIC DESCRIPTION OF LINE PICTURES AND LOCALIZATION OF OBJECTS [UNTERSUCHUNGEN ZUR SZENENANALYSE, SYMBOLISCHEN BESCHREIBUNG VON LINIENSZENEN UND OBJEKTLOLALISIERUNG]
M. Sties Bonn Bundeswehramt 1971 14 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVG-FBWT-71-25) Avail: NTIS; Bundeswehramt Bonn: 25 DM

International activities in the field of picture descriptions are discussed, and two different methods for the analysis and symbolic description of line-pictures are suggested. Both methods are based on mathematical graph theory. Geometrical and topological properties of lines and regions are evaluated. Localization of objects is done by comparison of known models with the picture. The criterion of success is not only identity, but also a specially defined similarity between model and object.
Author (ESRO)

N72-20198# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
OPERATIONS MANUAL FOR THE LAAS 2 ELECTRONIC CIRCUIT SIMULATION PROGRAM IN PULSED MODE [NOTICE D'UTILISATION DE LAAS 2, PROGRAMME DE SIMULATION DE CIRCUITS ELECTRONIQUES EN REGIME IMPULSIONNEL]
H. Jaladieu Oct. 1971 19 p ref In FRENCH
(LAAS-NT-SIS-71-T-03) Avail: NTIS

The LAAS 2 program is a computer program for simulating electric and electronic circuits including power and current sources, resistors, capacitors, diodes, and transistors giving the values of current and voltage on each branch of a network list and format of input data are defined and some explanations are given on the print-out.
ESRO

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-20199* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLOW RATE SWITCH Patent
George P. Gale, inventor (to NASA) Issued 4 Jan. 1972 19 p Filed 24 Sep. 1969 Supersedes N70-25729 (08 - 12, p 2187) Sponsored by NASA
(NASA-Case-NPO-10722; US-Patent-3,632,923; US-Patent-Appl-SN-860492; US-Patent-Class-200-81.9M; US-Patent-Class-335-205) Avail: US Patent Office CSCL 09E

A flow rate switch is described, which is suited for use in detecting variations in flow rates for fluids flowing through conduits of pressurized systems characterized by the utilization of a magnetically responsive circuit switching device. The device is seated within a tubular housing and a ring magnet is concentrically disposed about the housing and is adapted to be repositioned in opposite directions along the housing for effecting circuit switching in response to changes in flow rates. A feature of the switch is the employment of a flow-responsive and variably positioned pintle disposed about the housing, within the path of the fluids, supporting the magnet for displacement relative to the switching device for repositioning the ring magnet to effect switching as variation in flow rates occur.
Official Gazette of the U.S. Patent Office

N72-20200* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRICAL CONNECTOR Patent
Charles D. Baker, inventor (to NASA) Issued 28 Dec. 1971 11 p Filed 31 Mar. 1970 Supersedes N70-34708 (08 - 18, p 3327) Sponsored by NASA
(NASA-Case-NPO-10694; US-Patent-3,631,382; US-Patent-Appl-SN-24224; US-Patent-Class-339-275T; US-Patent-Class-339-276T) Avail: US Patent Office CSCL 09A

A method of fabricating a soldered electrical connector that can withstand heat sterilization is described. The connector is composed of a multiband conductor coupled with a barrel-and-lug terminal element; and a flexible electric conductor coupled with a terminal element so that the connector is rendered both mechanically and electrically reliable.
Official Gazette of the U.S. Patent Office

N72-20201# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONSTRUCTION OF I EQUALS 2 TORSATRON WITHOUT USE OF TOROIDAL COILS (SPAC-1)
S. Fujiwaka, A. Mohri, and M. Azumi (Kyoto Univ.) Oct. 1971 28 p refs
(IPPJ-T-6) Avail: NTIS

A simple method was proposed to generate average minimum B systems, where usual toroidal coils are not used. This method is a limit case of the short pitch of helical windings in Torsatron systems. A device adopting this method was constructed by using a machine developed for making the accurate former of helical windings, and it was named SPAC-1. The parameters of the helical windings were chosen so as to generate both elliptic magnetic surfaces and ringless quadrupole magnetic surfaces. The whole assembly of the device was completed.
Author

N72-20202*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRONIC SWITCHES AND CONTROL CIRCUITS: A COMPILATION
1971 22 p
(NASA-SP-5948(01)) Avail: NTIS CSCL 09A

The innovations in this updated series of compilations dealing with electronic technology represents a carefully selected collection of items on electronic switches and control circuits. Most of the items are based on well-known circuit design concepts that have been simplified or refined to meet NASA's demanding requirement for reliability, simplicity, fail-safe characteristics, and the capability of withstanding environmental extremes.
Author

N72-20203# Royal Aircraft Establishment, Farnborough (England).
HOLLOW CATHODE INVESTIGATIONS
H. Bessling Sep. 1971 32 p refs Transl. into ENGLISH from Proc. of DGLR Symp. on Elec. Propulsion Systems, Brunswick, West Germany, 22-23 Jun. 1971
(RAE-Lib-Trans-1601; BR-28316) Avail: NTIS

Two types of hollow cathode are described, one having a conventional barium-containing rolled foil insert and the other a solid tantalum insert containing no barium. Starting and operating characteristics obtained from the two types were almost identical, but the latter is far more robust and durable. A full investigation of the operating characteristics of the conventional cathode is described, with particular reference to minimising the energy required to produce an electron in both the plume and spot discharge modes. This energy was determined over wide ranges of mercury flow rate, discharge current, cathode temperature and keeper potential, and an approximate theory is presented which relates it to parameters of interest. Reference is made to the orifice erosion resulting from an aggregate operating time of 500 hours. It is concluded that a neutraliser system will have the lowest mass if plume mode operation is employed.
Author

N72-20204*# Translation Consultants, Ltd., Arlington, Va.
COMPENSATION FOR THE RESISTANCE OF CONNECTING WIRES IN A NONEQUILIBRIUM BRIDGE

D. P. Bespalov and G. M. Romanova Washington NASA Apr. 1972 8 p ref Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 216, 1967 p 143-147
(Contract NASw-2038)
(NASA-TT-F-14150) Avail: NTIS CSCL 09A

The possibility of using a 3-wire circuit in a nonequilibrium bridge to partially compensate for change in the resistance of the connecting wires is discussed. A rational scheme for a multirange installation to measure soil temperature when the measurement distance is 100 to 120 meters, which provides the best compensation for the resistance of the connecting lines, is proposed. The circuit component calculations used to produce the improved installation are given. Author

N72-20205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ISOLATED AMPLIFIER FOR MEASURING MILLIVOLT ELECTRICAL SIGNALS WITH REFERENCE TO A HIGH COMMON MODE POTENTIAL Patent Application
Robert C. Finke and Walter M. Krawczonek, inventors (to NASA) Filed 6 Mar. 1970 11 p
(NASA-Case-XLE-03155-2; US-Patent-Appl-SN-17102) Avail: NTIS CSCL 09E

The measurement of small electrical signals that are raised to high common mode potential, using a transmitter type device, is described. The transmitter receives the small signal voltage and produces a continuous train of light pulses. The light train output is received by a receiver electrically isolated from the transmitter and converted to a voltage signal that is indicated on suitable equipment. NASA

N72-20206*# Dumont Electron Tubes, Clifton, N.J.
HIGH CONTRAST CATHODE RAY TUBE Patent Application
Edward J. Lisovicz and Thomas G. Catlaw, inventors (to NASA) Filed 19 May 1971 11 p
(Contract NAS12-2135)
(NASA-Case-ERC-10468; US-Patent-Appl-SN-144958) Avail: NTIS CSCL 09E

A layer of material is described, which contains fine grains of phosphor material stimulated by electrons to produce visible radiation. The layer, which also contains fine grains of cobalt oxide, is deposited on the glass screen of a cathode ray tube to provide high contrast, by absorbing most of the visible radiation which is directed to the layer through the screen, while not materially affecting the visible light which the phosphor material produces in response to the electron stimulation. NASA

N72-20207# National Research Council of Canada, Ottawa (Ontario).
DEVICE FOR AGING PHOTOTUBES
T. N. Andreeva and V. E. Kartashevskaya 1972 7 p Transl. into ENGLISH from Tr. Vses. Nauch.-Issled. Inst. Metrol. Im. D. I. Mendeleeva (USSR), v. 114, no. 174, 1970 p 124-127
(NRC-TT-1536) Avail: NTIS

A device for aging phototubes is described which can test the spectral sensitivity of 12 phototubes simultaneously. It consists of a sphere with 12 tubes and four lamps, a feeding block for the phototubes, and electromeasuring units for determining the photocurrent, the anodic current, and the lamp voltage and current. F.O.S.

N72-20208# National Research Council of Canada, Ottawa (Ontario).
NUMERICAL METHOD OF CALCULATING THE CAPACITANCE OF ELECTRIC CONDENSERS
E. Kacki 1972 12 p refs Transl. into ENGLISH from Przegl. Electrotech. (Poland), v. 44, no. 3, 1968 p 114-116
(NRC-TT-1531) Avail: NTIS

A circuit comprising two surfaces not touching at any point is considered; these surfaces are good conductors. They are placed in a nonconducting, homogeneous, isotropic medium of electric inductive capacity. It was assumed that each of these surfaces creates an independent circuit. The case of two cylindrical surfaces, a closed restricted surface enveloping another restricted surface, two adjacent bounded surfaces, and an isolated limited surface are also investigated. J.A.M.

N72-20209*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INDUCTANCELESS FILTER AMPLIFIER Patent Application
William J. Kerwin and Lawrence P. Huelsman, inventors (to NASA) Filed 20 Mar. 1967 23 p
(NASA-Case-XAC-05462; US-Patent-Appl-SN-624611) Avail: NTIS CSCL 09E

The active filter circuit comprises a passive RC network and a dc voltage or operational amplifier. The resistive and capacitive elements of the passive RC network determine the location of a pair of complex conjugate zeros along the j-omega axis. Connected to the RC network in shunt are a load resistor and a load capacitor. A feedback network connects the output of the voltage amplifier with the passive network. By regulating the values of the load resistor and capacitor jointly or severally, the location of a pair of complex conjugate poles produced by the active filter can be adjusted separately and independently from the zeroes. When a number of active filter circuits are connected in cascade, a frequency-selective amplifier is formed with the dc amplifiers, which also serve as isolation devices between successive active filter circuits. NASA

N72-20210# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
VARIATION OF THE OSCILLATION AMPLITUDES OF LINEAR OSCILLATORS CROSSING THE SECOND-ORDER RESONANCE
P. R. Zenkevich 1970 8 p refs In RUSSIAN, ENGLISH summary
(ITEF-812) Avail: AEC Depository Libraries

Variation of the oscillation amplitudes of linear oscillators crossing the second-order resonance (half-integer resonance or coupling resonance) is theoretically investigated. The transfer matrices for the ampitudes are determined. This method may be applied to investigate other acclerator theory problems.
Author (NSA)

N72-20211# Sandia Corp., Albuquerque, N.Mex. Facilities/Test Equipment Design and Development Div.
PEGASUS CAPACITOR BANK
Ken J. Kutac Nov. 1971 73 p refs Sponsored AEC
(SC-DR-710324) Avail: NTIS

The Pegasus capacitor bank is a 600-kJ, 60-kV discharge source that will be used in plasma physics research. The bank contains 156 capacitors in the primary and 12 capacitors in the preionization section. Spark-gap switching is used on all the capacitors and in the triggering system of the bank. Jitter times of 20 nsec are obtained on all the spark-gap switches. The five sections of the bank are described. These sections are (1) charging, (2) trigger, (3) capacitor and spark gap, (4) load, and (5) electronic control. This system was installed and is being made operational Author (NSA)

N72-20212# Sandia Labs., Albuquerque, N.Mex.
NEUTRON INDUCED DEGRADATION AND FAILURE IN HIGH POWER LSA DIODE OSCILLATORS
W. E. Wilson and B. L. Gregory Nov. 1971 10 p refs Sponsored by AEC
(SC-R-713407) Avail: NTIS

The effects of neutron irradiation on oversized epitaxial GaAs diodes operated in the LSA relaxation mode were studied. The expected material degradation effects are related to circuit performance by use of a simplified circuit analysis which neglects starting and harmonic effects. The experimentally determined material and oscillator characteristics are reported for diodes having two different initial doping concentrations. These

results are compared to the theory to obtain general conclusions about the radiation effects on LSA oscillators. Author (NSA)

N72-20213# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
METHOD FOR COUNTING LOSSES MEASUREMENTS USING LIGHT DIODES
A. V. Kuptsov and D. M. Khazins 1971 11 p refs In RUSSIAN
(JINR-P13-6018) Avail: AEC Depository Libraries

The direct method for measurements of counting losses, which take place in complicated registering apparatus, including scintillation and Cerenkov counters, is proposed. The main point of the method is simulation by light diodes of events for which the registering apparatus is aimed. The number of counting losses is given by the fraction of simulated events lost during registration. The application of the method is illustrated. Possible systematic errors and limitations are discussed. Author (NSA)

N72-20214# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etude Nucleaires.
SEMI-FAST PROPORTIONAL AMPLIFIER (MAP 16)
Andre Petin, Marcellin Rogerieux, Gerard DeRosny, and Jean-Claude Sarles Jul. 1971 27 p In FRENCH
(CEA-N-1432) Avail: AEC Depository Libraries

The structure of a semi-fast proportional amplifier intended for a gamma spectrometry unit is described, and some measurements are presented. The structure adopted has a rise time of less than 30 ns, which remains fairly constant with increasing gain. Considerable importance was attached to reducing the thermal drifts in the gain and continuous level and reducing the relative input noise. NSA

N72-20215# Argonne National Lab., Ill.
DESIGN PROCEDURES FOR MATCHED AND BROAD-BANDING FILTERS FOR SCANNING TESTS
Cyrus W. Cox Aug. 1971 23 p refs
(Contract W-31-109-eng-38)
(ANL-7832) Avail: NTIS

Design procedures are set forth for matched filters to improve the fidelity in scan-type nondestructive tests. The realizations are approximate, as such realizations must be, but the procedures used are relatively simple and straightforward. Adjustments of a design to accommodate changes in scanning speed and to allow use of nominal component values are also included. Author (NSA)

N72-20216# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung instrumentierung und anthropotechnik.
MICROMESH FILTERS FOR CONTRAST ENHANCEMENT OF ELECTRONIC DISPLAYS
Josef Thomas 1971 42 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-73) Avail: NTIS; DFVLR, Porz: 11 DM

The possibilities of cockpit cathode ray tube display contrast enhancement are investigated, and a choice is made of the screen mounted micromesh optical filter. The loss of contrast in cockpit electronic displays by high ambient light conditions necessitates the application of contrast enhancing filters. A survey is given of thin media, neutral gray filters, circularly polarized filters, fiber optical filters, and micromesh filters. Two different micromesh filters are photometrically evaluated, and point to usefulness in practical operation. The results suggest the necessity of quantitative data with respect to the CRT beam luminance to achieve an adequate contrast range and sufficient contrast under given conditions. ESRO

N72-20217# Helsinki Univ. (Finland). Radio Lab.
PERFORMANCE COMPARISON OF BROAD-BAND PARAMETRIC AMPLIFIERS
V. Porra, p. Someruvo, Y. Sirkeinen, and A. Kaakinen 1971 6 p refs Presented at the European Microwave Conf., Stockholm, 1971 Sponsored jointly by Suomen Kulttuurirahasto and Tek. Edistaemissaeaetioe Found. and Finn. State Comm. for Tech. Sci. Submitted for publication
(S-44-1971) Avail: NTIS

The theoretical bandwidth capabilities of various broadband single- and multistage nondegenerate parametric amplifier configurations are compared. Study was based on two microstrip parametric amplifier designs. The range of varactor parameters is calculated, inside which certain minimum gain and bandwidth can be achieved by returning the amplifier electrically with the aid of pump frequency, pump power, and bias voltage. The amplifier has a single tune idler circuit and a double tuned signal circuit. Experimental data are given. ESRO

N72-20218# Standard Electrik Lorenz A. G., Stuttgart (West Germany).
DEVELOPMENT TENDENCIES IN SPACE ELECTRONICS [ENTWICKLUNGSTENDENZEN IN DER RAUMFAHRT-ELEKTRONIK]
H. Reiner Cologne DGLR 1971 18 p In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A survey is given of present and future trends in the development of spacecraft electronic equipment and the differences between spacecraft and commercially available electronic equipment such as weight, power dissipation, environmental conditions, and reliability. The role of silicon planar technology, thin films, and the influence of future long space missions on design, are discussed. ESRO

N72-20219# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
COMBINATIVE MULTIPLIERS [LES MULTIPLIEURS COMBINATOIRES]
J. C. Laprie Oct. 1971 16 p refs In FRENCH
(LAAS-NT-TNPI-71-T-02) Avail: NTIS

The aim of this document is to evaluate how, using the complex logical circuits available on the market, one can perform multiplication by a combinational method. Two possibilities are analyzed: use of iterative cells, and tabulation on passive mnemonics. ESRO

N72-20220# Defence Research Information Centre, Orpington (England).
TIME-BASED GENERATORS FOR A VIDICON
V. M. Khoroshaev and V. V. Podlipenskii Jan. 1972 7 p refs Trans. into ENGLISH from Tekhn, Kino Telev, (Moscow), v. 15, no. 5, May 1971 p 64-65
(AD-734805; DRIC-Trans-2583; DRIC-BR-27626) Avail: NTIS CSCL 09/1

The article describes a worked out and experimentally verified time-base generator for a vidicon LI-420, which is notable for simplicity. The time-base generator for line (15,625 Kcs) and frame (50cs) frequencies includes six transistors. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-20221* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONOSTABLE MULTIVIBRATOR Patent
Leonard L. Kleinberg, inventor (to NASA) Issued 4 Jan. 1972

10 p Filed 28 May 1970 Supersedes N70-34557 (08 - 18, p 3326)
(NASA-Case-GSC-10082-1; US-Patent-3,633,048;
US-Patent-Appl-SN-41430; US-Patent-Class-307-273;
US-Patent-Class-307-288; US-Patent-Class-307-313;
US-Patent-Class-328-207; US-Patent-Class-330-30D) Avail: US Patent Office CSCL 09C

A monostable multivibrator for producing a fixed duration output pulse, without the dissipation of power in the standby state, is described. The system consists of a semiconductor circuit comprising an input network, a normally conducting switching circuit, an output transistor, and a coupling capacitor. The system was designed primarily for use in spacecraft systems, but may be applied to balloons. E.H.W.

N72-20222* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPLIT RANGE TRANSDUCER Patent
Tom D. Finley, inventor (to NASA) Issued 25 Jan. 1972 7 p Filed 31 Dec. 1969 Supersedes N70-42163 (08 - 24, p 4482)
(NASA-Case-XLA-11189; US-Patent-3,638,114;
US-Patent-Appl-SN-889375; US-Patent-Class-324-115;
US-Patent-Class-324-132) Avail: US Patent Office CSCL 09C

A nonlinear circuit is connected to the output of a current-producing transducer to form a split range transducer. In the range where most of the data to be measured is expected, the resolution is high. In the other range the resolution is lower.
Official Gazette of the U.S. Patent Office

N72-20223* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIDE BAND DOUBLER AND SINE WAVE QUADRATURE GENERATOR Patent
Robert B. Crow, inventor (to NASA) Issued 7 Dec. 1971 15 p Filed 23 Dec. 1969 Supersedes N70-34663 (08 - 18, p 3314) Sponsored by NASA
(NASA-Case-NPO-11133; US-Patent-3,626,308;
US-Patent-Appl-SN-887685; US-Patent-Class-328-166;
US-Patent-Class-328-16; US-Patent-Class-328-20;
US-Patent-Class-328-38; US-Patent-Class-307-295) Avail: US Patent Office CSCL 09C

A wideband generator system for producing sine waves and the second harmonic of an input signal is described. The system is composed of a voltage controlled phase shifter which provides an output representing a phase shifted sine input signal. The input signal and the phase shifter's output are multiplied by a multiplier whose output, after integration, is used to control the illumination levels of photoresistors in the phase shifter so that the output of the phase shifter is the cosine of the sine input signal. The multiplier's output when phase lock is achieved is the second harmonic of the sine input signal. The photoresistors in the phase shifter have large dynamic ranges of resistance changes to enable the generator to operate over a wide band of input signal frequencies.
Official Gazette of the U.S. Patent Office

N72-20224* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SIGNAL PHASE ESTIMATOR Patent
Stanley Butman, inventor (to NASA) Issued 28 Dec. 1971 21 p Filed 19 Jan. 1970 Supersedes N70-34700 (08 - 18, p 3314) Sponsored by NASA
(NASA-Case-NPO-11203; US-Patent-3,631,351;
US-Patent-Appl-SN-03696; US-Patent-Class-328-133;
US-Patent-Class-324-83A; US-Patent-Class-324-85;
US-Patent-Class-343-12) Avail: US Patent Office CSCL 09C

An apparatus is described for estimating the amplitude and sign of the phase difference or time delay between a first signal z(t) and a second signal. One replica s(t) of the second signal and another s(t + (T/4)), delayed a quarter period T, are related to the first signal. The equations for the relationship are given.
Official Gazette of the U.S. Patent Office

N72-20225* Technology, Inc., San Antonio, Tex.
CONTOUROGRAPH SYSTEM FOR MONITORING ELECTROCARDIOGRAMS Patent
Donald P. Golden, Jr., Donald G. Mauldin, and Roger A. Wolthuis, inventors (to NASA) Issued 25 Jan. 1972 9 p Filed 21 Aug. 1970 Sponsored by NASA
(NASA-Case-MSC-13407-1; US-Patent-3,638,066;
US-Patent-Appl-SN-65840; US-Patent-Class-315-25;
US-Patent-Class-315-22) Avail: US Patent Office CSCL 09C

The system processes semiperiodic electrical signals, such as an electrocardiogram, to produce a real time signal display on the face of a variable persistence cathode ray tube in an oscilloscope. Each cycle of the signal being processed is formed on a separate horizontal base line which is spaced vertically below the trace formed by the preceding cycle. Each waveform is organized about a prominent cyclical event with all similar events with aligning in approximately the same vertical plane. The system intensifies portions of each trace to produce a three-dimensional contour effect. The resultant display called a contourogram tends to suppress cycle-to-cycle redundancies and to emphasize cycle-to-cycle differences, which increases ability to visually detect any waveform anomalies representative of an abnormality associated with the signal source.
Official Gazette of the U.S. Patent Office

N72-20226*# Purdue Univ., Lafayette, Ind.
SNAP: A COMPUTER PROGRAM FOR GENERATING SYMBOLIC NETWORK FUNCTIONS
P. M. Lin and G. E. Alderson Aug. 1970 125 p refs
(Grant NGL-15-005-021)
(NASA-CR-125887; TR-EE-70-16) Avail: NTIS CSCL 09B

The computer program SNAP (symbolic network analysis program) generates symbolic network functions for networks containing R, L, and C type elements and all four types of controlled sources. The program is efficient with respect to program storage and execution time. A discussion of the basic algorithms is presented, together with user's and programmer's guides. K.P.D.

N72-20227# Bochum Univ. (West Germany). Abteilung fuer Elektrotechnik.
ON THE THEORY OF PSEUDO-N-PATH FILTERS AND THEIR REALIZATION Ph.D. Thesis
Horst Wupper Mar. 1971 147 p refs
Avail: NTIS

A review of the development of N-path filters is presented. The derivation of pseudo-N-path filters and their analysis are considered. A method is presented which leads to the solution of problems associated with the practical realization of N-path filters. This method involves the elimination of unwanted sideband voltages and residual carrier voltages in the passbands of N-path bandpass filters. An inductorless auxiliary filter for the suppression of unwanted components in the output spectrum of a pseudo-N-path filter is discussed briefly. K.P.D.

N72-20228# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany).
SELF-ADAPTIVE CONTROL SYSTEMS IN DRIVING TECHNOLOGY Ph.D. Thesis [SELBSTANPASSENDE REGELSYSTEME IN DER ANTRIEBSTECHNIK]
Winfried Speth 4 Feb. 1971 194 p refs In GERMAN
Avail: NTIS

The different designs which can be used in constructing adaptive regulators were compared and certain ones selected which were best suited for the requirements of driving technology. Various developments of the basic form of the selected designs through autonomizing of the ciruits were demonstrated. The most customary driving regulators are classified according to the continuous structure and for each class an adaptive regulator was built and tested with an analog computer. Transl. by P.N.F.

N72-20229# Technische Univ., Berlin (West Germany). Fachbereich Mathematik.
ON OPTIMIZATION PROBLEMS WITH LIMITED PHASE VARIABLES Ph.D. Thesis [UEBER OPTIMIERUNGSPROBLEME MIT EINGESCHRAENKTEN PHASENVERAENDERLICHEN]
Gisela Plate 16 Apr. 1971 113 p refs In GERMAN
Avail: NTIS

A numerical analysis of optimization problems is presented. The problems are described by differential equations of the first order and the underlying bounds of certain state variables. Mathematical models are included to support the various theories which are advanced. The minimizing of variational curves restricted to a prearranged set is explained.
Transl. by P.N.F.

N72-20230# Technische Univ., Berlin (West Germany).
EDDY CURRENT DISTRIBUTION IN PARALLEL CONDUCTORS Ph.D. Thesis [WIRBELSTROMVERTEILUNG IN PARALLELEN LEITERN]
Matthias Ehrich 1970 134 p refs In GERMAN
Avail: NTIS

A numerical analysis of the electrical properties and distribution of eddy currents in parallel conductors is presented. The conditions existing in conductors in the form of thin plates, wide plates, and circular cylinders are examined. Computer programs for solving the mathematical relationships are explained. The following assumptions were imposed on conditions affecting the eddy currents over a cross section of the conductor: (1) omission of the capacitance current, (2) constant permeability in space, and (3) the field strength does not depend on the longitudinal direction of the conductor. Transl. by P.N.F.

N72-20231*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW PHASE NOISE DIGITAL FREQUENCY DIVIDER Patent Application
George F. Lutes, Jr., inventor (to NASA) Filed 18 Nov. 1971 23 p
(Contract NAS7-100)
(NASA-Case-NPO-11569; US-Patent-Appl-SN-199957) Avail: NTIS CSCL 09C

A low phase noise frequency divider is described which consists of a gating arrangement which supplies selected portions of an input reference signal to be divided to a tuned circuit without any phase noise due to the gating action. The arrangement consists of a FET which is connected to the tuned circuit input to short out the input except when the input reference signal amplitude crosses ground level in a positive direction and a gate-enabling signal is present at the gate electrode of the FET. The gate enabling signal alone does not decouple the tuned circuit input from ground, therefore phase noise, due to the leading and trailing edges of each gate-enabling signal, is substantially eliminated. NASA

N72-20232*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VOLTAGE CONTROLLED OSCILLATOR CIRCUIT Patent Application
Frank J. Nola, James R. Currie, and Harry Reid, Jr., inventors (to NASA) Filed 19 Jan. 1972 17 p
(NASA-Case-MFS-21465; US-Patent-Appl-SN-218965) Avail: NTIS CSCL 09C

A voltage controlled oscillator circuit, single or two phased, in which there is employed a first and second differential amplifier, is described. The first differential amplifier is employed as an integrator for developing equal and opposite slopes proportional to the input voltage, and the second differential amplifier functions as a comparator to detect equal amplitude positive and negative selected limits and provides switching signals which gate a transistor switch which switches the integrating differential amplifier between charging and discharging modes. This provides an output of the first differential amplifier which is triangular and which upon the application of wave shaping provides a substantially sinusoidal output signal. A two phased version, adds a second, like, integrator which is switched between charging and discharging modes by a zero crossing detector responsive to the output of the first integrator to provide a second, 90 degree phase shifted, output. NASA

N72-20233*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNAL TO NOISE RATIO DETERMINATION CIRCUIT Patent Application
Leonard F. Deerkoski, inventor (to NASA) Filed 15 Sep. 1971 15 p
(NASA-Case-GSC-11239-1; US-Patent-Appl-SN-180683) Avail: NTIS CSCL 09C

A signal to noise ratio (SNR) determination circuit is described for an input having signal components within a given frequency range and noise components, without actual measurement of the noise. Input means receive the input, and first filter means, having a frequency bandpass range different from the given frequency range, are connected to the input means to convert the db level of the input SNR to another level. Bandpass limiter means with a constant signal plus noise output level are connected to the output of the first filter means for a given db range of converted SNR input levels. Means for calibration are connected to the bandpass limiter and are responsive to the signal components at the output to derive the SNR of the input to the determination circuit. The apparatus described can be used in a diversity receiver with a number of input channels. The channels are weighted prior to summation to provide maximum signal to noise ratio at the output of a combiner. NASA

N72-20234# Danish Research Centre for Applied Electronics, Copenhagen.
THICKFILM MICROWAVE CIRCUITS: AN EVALUATION OF MATERIALS AND PROCESSES FOR THICKFILM STRIPLINES AT MICROWAVE FREQUENCIES
E. Andersen and S. T. Olesen Feb. 1972 66 p refs
(ECR-26) Avail: NTIS

Evaluation of materials, manufacturing parameters, and manufacturing methods for passive microstrip circuits, based on thickfilm technique, are described. The investigations concerned the use of microstrips in the microwave range from 1 to 10 GHz. The influence of metal type and layer thickness of the conductive material was evaluated, together with the width of the striplines and the edge resolution at printed and etched lines. Further the type of ceramic substrate material was evaluated, and the Q values and transmission losses of strips made with a range of different fabrications and ceramic alloys were measured. A method for etching of gold and silver strips was also developed. Author

N72-20235# Electrotechnical Lab., Tokyo (Japan).
FUNCTIONAL COMPLETENESS AND STRUCTURE OF THREE-VALUED LOGIC 1. CLASSIFICATION OF P3
Masahiro Miyakawa Jun. 1971 90 p refs
(Rept-717) Avail: NTIS

A complete classification of the set of all 3-valued logical functions (denoted by P3) is performed by using the presented characterization of maximal sets. This classification is the one by the degrees of functional completeness. In the classification process functional structure of P3 is clarified. The existence of only 418 nonempty classes is shown. Futher, the existence of functions which depend on at most 3 variables in each class is shown. Author

N72-20236*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE m-ARY LINEAR FEEDBACK SHIFT REGISTER WITH BINARY LOGIC Patent Application
Marvin Perlman, inventor (to NASA) Filed 26 Oct. 1971 26 p

(Contract NAS7-100)
(NASA-Case-NPO-11868; US-Patent-Appl-SN-192101) Avail: NTIS CSCL 09C

Each m-ary linear feedback shift register with binary logic generates a binary representation of a nonbinary recurring sequence, producable with an m-ary linear feedback shift register without binary logic, in which m is greater than 2. The state table of the m-ary shift register, utilizing sum modulo m feedback, is tabulated for a given initial state. The entries in the table are coded in binary and the binary entries are used to set the initial states of the stages of a number of binary shift registers. A single feedback logic unit provides a separate feedback binary digit to each register. The stages which are fed back depend on the stages fed back through nonzero multipliers in the m-ary shift registers. NASA

N72-20237*# Iowa Univ., Iowa City. Dept. of Electrical Engineering.
BOUNDED STATE SPACE Final Report, Mar. 1970 - Sep. 1971
Earl D. Eyman 1 Mar. 1972 42 p refs
(Grant NGR-16-001-090)
(NASA-CR-125911) Avail: NTIS CSCL 09C

This investigation is divided functionally into three different areas: (1) study of bounded state space, (2) nonlinear smoothing theory, and (3) system identification. (1) Study of bounded state space: necessary and sufficient conditions for an optimal control are obtained for a bounded state space optimal control problem. The difficulty of determining the so-called jump conditions is eliminated; however, the problem of determining the points where the response either enters or leaves the boundary still remains unsolved. (2) Nonlinear smoothing theory: nonlinear fixed-interval, fixed-point and fixed-lag smoothing of a random signal generated by a stochastic differential equation are investigated. Results on the asymptotic stability of a linear constant-parameter fixed-interval smoothing filter are obtained. (3) System indentification: a particular stochastic modelling problem is solved. An Ito stochastic integral equation is used to mathematically model a black box having multiple inputs and multiple outputs. A new method for identifying system parameters is presented. Author

N72-20238# Bochum Univ. (West Germany).
ON THE SYNTHESIS OF LOSS-FREE TWO PORTS THROUGH FACTORIZATION OF OPERATING PARAMETER MATRICES Ph.D. Thesis [ZUR SYNTHESE VERLUSTFREIER ZWEITORE DURCH FAKTORZERLEGUNG DER BETRIEBSPARAMETERMATRIZEN]
Horst-Peter Okolowitz 23 Feb. 1971 148 p refs In GERMAN
Avail: NTIS

The scattering matrix and the operating hybrid matrix of loss free two ports, by using factorization techniques similar to those used for matrices of a lower grade, are discussed. This procedure leads to new network synthesis possibilities and provides for the solution of a system of linear, homogeneous equations, as well as a futher nonlinear relationship. An operating chain matrix was investigated in which the factorization of the operating parameter matrices for practical calculation of the circuit is possible. It was determined that filters with narrow passages between the port and barricade areas cannot be calculated by simple mathematics. It is necessary to use algorithms of factorization through suitable frequency transformations. Transl. by P.N.F.

N72-20239# Toulouse Univ. (France).
CONTRIBUTION TO THE IMPLANTATION OF LOGIC FUNCTIONS IN CELLULAR NETWORKS Ph.D. Thesis [CONTRIBUTION A L'IMPLANTATION DE FONCTIONS LOGIQUES SUR DES RESEAUX CELLULAIRES]
Jean-Claude Ippolito 21 Dec. 1971 216 p refs In FRENCH
(Rept-456) Avail: NTIS

A brief review is presented of the major studies of cellular networks and the problems they involve. Two methods of network synthesis are discussed, based on the adaptation of classical Boolean properties. One method is applied to networks in cascades, the other to rectangular two-dimensional networks. A method is developed specifically for the study of cellular networks. This method uses the properties of threshold elements which permit a simple derivation of network function from a system of linear inequalities. The resolution of this system leads to the solution of a linear programming problem in bivalent variables for which two algorithms are proposed.
Transl. by K.P.D.

N72-20240*# Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
TRANSPARENT SWITCHBOARD Patent Application
Hans Peter Rasmussen, inventor (to NASA) Filed 15 Feb. 1972 27 p
(Contract NAS9-4065)
(NASA-Case-MSC-13746-1; US-Patent-Appl-SN-226476) Avail: NTIS CSCL 09C

A thin oxide coating is formed on a plate of glass and the coating is then etched away from the glass in thin lines to form separate electrical conductors extending to one end of the plate and connected to either a vertical or horizontal position-sensing SCR circuit. A thin transparent insulating coating is formed over the oxide layer except at selected points, positioned in a matrix of columns and rows. Touching one of these points with a finger bridges the thin line between adjacent conductors to activate trigger circuits in the particular row and column sensing circuits associated with the point touched. The signals from the sensing circuits are input to a logic circuit which determines the presence of a valid touch, a binary matrix number for the point, signals a computer of the presence of a stored number, and prevents storage of a new number before receiving an enable signal from the computer. NASA

N72-20241*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
SOLID STATE MICROWAVE ELECTRONICS Quarterly Report
P. L. Penfield, Jr., D. H. Steinbrecher, and A. Chu 15 Jan. 1972 9 p refs
(Grant NGL-22-009-304; Contract DAAB07-71-C-0300; Grant NIH R-R00317)
(NASA-CR-125914; QPR-104-Pt-5) Avail: NTIS CSCL 09C

The research for improving the resolution and stability in the CEC 21-110 double-focusing mass spectrometer is reported. The types of experiments beyond the performance capability of the present instrument are given, and a control system that introduces changes in the magnetic field to maintain the position of a given mass peak is described for stabilizing the instrument. F.O.S.

N72-20242# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
ELECTRONIC TIME RELAYS WITH TIME-GENERATING RC CIRCUITS WITH THE DELAYS FROM 1 TO 10 SECONDS
V. G. Rybakov 1970 18 p refs In RUSSIAN
(IFVE-SEF-70-81) Avail: AEC Depository Libraries

Electron time relays with long delays are presented with the experimental data on the tests of the parameters of the time relay units (transistors, capacitors) and on the tests of the time-relay circuit stability. Conclusions were made on ways of improving the time-relay stability. Author (NSA)

N72-20243# Sandia Labs., Albuquerque, N.Mex.
EXCITATION OF A COAXIAL LINE BY THE PROPAGATION OF AN ELECTROMAGNETIC FIELD THROUGH A TRANSVERSE SLOT IN THE SHEATH
Charles W. Harrison, Jr. and Ronol D. W. P. King Oct. 1971 22 p refs Sponsored by AEC
(SC-R-713325) Avail: NTIS

A rocket with removed access plate is simulated by a

section of coaxial transmission line with a transverse elliptical slot cut in its sheath. The internal circuit consists of two arbitrary impedances in series with the inner conductor at its ends. The object is to find the currents in these impedances when the cylinder is illuminated from the outside by an electromagnetic field that enters the aperture and excites the internal circuit. The problem is solved by application of the reciprocal theorem. The current in a dipole antenna is determined when this is in the far field maintained by the slotted coaxial line when driven by a generator in series with one of the load impedances. The field in the aperture is replaced by equivalent electric and magnetic dipoles. The reciprocal theorem gives the current in the load impedance when the distant dipole is driven. A numerical example is given. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-20244* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTIMAL CONTROL SYSTEM FOR AN ELECTRIC MOTOR DRIVEN VEHICLE Patent
Yilmaz Sahinkaya, inventor (to NASA) Issued 28 Dec. 1971 14 p Filed 28 Nov. 1969 Sponsored by NASA
(NASA-Case-NPO-11210; US-Patent-3,630,304; US-Patent-Appl-SN-880831; US-Patent-Class-180-105E; US-Patent-Class-123-102; US-Patent-Class-318-308; US-Patent-Class-318-327; US-Patent-Class-318-376) Avail: US Patent Office CSCL 13F

Operating conditions experienced by a battery-operated vehicle, driven by one or more permanent magnet or separately excited dc motors, are sensed and converted into a control signal. The control signal is applied to a pulse width modulator which controls the conduction periods of SCR's in such a way that the average motor armature voltage is proportional to the control signal. In a motoring mode the pulse width modulator operates SCR's to supply current from the battery to the motor armature circuit. This mode usually occurs when the vehicle is moving uphill or accelerating on a level terrain. In a generating mode the pulse width modulator operates SCR's to supply current from the motor armature circuit to the battery. This occurs when the vehicle is moving downhill or is decelerating on a level terrain. The required mode of operation is accomplished automatically by the action of a motor armature current direction sensing circuit. Official Gazette of the U.S. Patent Office

N72-20245*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA DIRECTORY OF OBSERVATION STATION LOCATIONS, VOLUME 1
Nov. 1971 275 p refs 2 Vol.
(NASA-TM-X-68818) Avail: NTIS CSCL 14B

Geodetic information is presented for NASA tracking stations and observation stations in the NASA geodetic satellites program. A geodetic data sheet is provided for each station, giving the position of the station and describing briefly how it was established. Geodetic positions and geocentric coordinates of these stations are tabulated on local or major geodetic datums, and on selected world geodetic systems when available information permits. Author

N72-20246*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA DIRECTORY OF OBSERVATION STATION LOCATIONS, VOLUME 2
Nov. 1971 387 p refs 2 Vol.
(NASA-TM-X-68819) Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

The directory documents geodetic information for NASA tracking stations and observation stations in the NASA Geodetic Satellites Program, including stations participating in the National Geodetic Satellite Program. Station positions of these facilities are given on local or preferred major datums, and on the Modified Mercury Datum 1968. A geodetic data sheet is provided for each station, giving the position of the station and describing briefly how it was established. Geodetic positions and geocentric coordinates of these stations are tabulated on local or major geodetic datums, and on selected world geodetic systems when available information permits. Author

N72-20247*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
STUDY OF ALTERNATE METHODS OF DISPOSAL OF PROPELLANTS AND GASES AT KSC
W. I. Moore 5 Jun. 1970 27 p
(NASA-TM-X-67652; KSC-SE-2-70) Avail: NTIS CSCL 14B

A comprehensive study was conducted at KSC launch support facilities to determine the nature and extent of potential hazards from propellant and gas releases to the environment. The results of the study, alternate methods for reducing or eliminating the hazards, and recommendations pertaining to these alternatives are presented. The operational modes of the propellant or hazardous gas systems considered include: system charging, system standby, system operation, and post-test operations. The results are outlined on an area-by-area basis. D.L.G.

N72-20248# National Academy of Engineering, Washington, D.C. Environmental Studies Board.
JAMAICA BAY AND KENNEDY AIRPORT: A MULTIDISCIPLINARY ENVIRONMENTAL STUDY. VOLUME 1: CONCLUSIONS, RECOMMENDATIONS, SUMMARY
1971 41 p
(ISBN-0-309-01871-4-Vol-1; LC-78-610437-Vol-1) Avail: NTIS

Several possible runway configurations extending into Jamaica Bay from Kennedy Airport were studied, one of which was suggested by the Port of New York Authority. These were considered in relation to the natural ecosystem of the bay; existing or proposed programs for water quality improvement, recreation, and conservation; and present and expected land usage patterns near the airport. It was concluded that any runway construction will damage the natural environment of the bay and reduce its potential use for conservation, recreation, and housing. The degree of this impairment will be dependent upon the amount of bay area taken for the airport extension. It is possible to improve the bay environment by technological means. Such improvements may be made independently of any airport expansion scheme, but any expansion would increase the economic costs or dilute the benefits of these improvements. Author

N72-20249# National Academy of Engineering, Washington, D.C. Environmental Studies Board.
JAMAICA BAY AND KENNEDY AIRPORT: A MULTIDISCIPLINARY ENVIRONMENTAL STUDY, VOLUME 2
1971 162 p refs
(ISBN-0-309-01871-4-Vol-2; LC-78-610437-Vol-2) Avail: NTIS

The task of improving the environment is considered in relation to competing needs of air and ground transportation. The future of Jamaica Bay, the Kennedy Airport and community development, and the national air transportation policy are discussed. Among the topics studied are the needs and alternatives of air transportation for the New York region; Jamaica Bay as a resource for the people of New York City and the surrounding area; present effects of aviation in the environs of Kennedy Airport; effects of improved technology and of runway extensions; and national issues raised by the Jamaica Bay study. K.P.D.

N72-20250*# Tracor, Inc., Austin, Tex.
PRELIMINARY EVALUATION OF THE EFFECT OF A DYNAMIC PREFERENTIAL RUNWAY SYSTEM UPON COMMUNITY NOISE DISTURBANCE
Harrold P. Patterson, Richard P. Edmiston, and William K. Connor 7 Feb. 1972 91 p refs
(Contract NASw-2293; TRACOR Proj. 076-163-01)
(NASA-CR-125821; T-72-AU-9016-U) Avail: NTIS CSCL 01E

A dynamic preferential runway system (DPRS) was developed for John F. Kennedy International Airport for the purpose of controlling short term noise exposure in the neighboring communities. The DPRS is a computer-aided procedure for optimum selection of runways from the standpoint of noise and is based upon a community disturbance model which takes into account flyover levels, size of exposed populations, time of day and week, and persistence of overflights. A preliminary evaluation of the DPRS is presented on the basis of social survey data and telephone complaint records, for the trial period of August and September, 1971. Comparative use is made of data taken in a previous survey of the same community areas in 1969. Author

N72-20251*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL CONTROL OF RANDOM EXCITATION ENVIRONMENTAL TESTING Patent Application
Carl P. Chapman and Bernardo Sotomayor, inventors (to NASA) Filed 18 Nov. 1971 41 p
(Contract NAS7-100)
(NASA-Case-NPO-11612; US-Patent-Appl-SN-199907) Avail: NTIS CSCL 14B

Digitally controlled random noise vibrational testing is described, in which a programmed digital computing system samples the response of a test specimen to vibration induced by a control signal, converts it to digital form, and provides a Fourier transformation to permit power spectrum analysis. This is done by obtaining the difference between the square root of a desired power spectrum and the square root of the actual response power spectrum. The difference spectrum is multiplied by a convergence control factor, and the product is added to the last output spectrum. A complex Fourier spectrum is then formed from the output spectrum thus produced. An inverse Fourier transformation finally produces a control signal in digital form which is converted into a control signal in analog form.
NASA

N72-20252*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TEST STAND SYSTEM FOR VACUUM CHAMBERS Patent Application
Dewey F. Newman, inventor (to NASA) Filed 23 Dec. 1971 10 p
(NASA-Case-MFS-21362; US-Patent-Appl-SN-211411) Avail: NTIS CSCL 14B

A test stand, designed to utilize all of the space inside a bell jar type vacuum system, is described. The stand affords simultaneous testing of several test setups and may be rotated from outside during tests without interfering with the vacuum. The stand is economical and simple in design. NASA

N72-20253*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPEN TUBE GUIDEWAY FOR HIGH SPEED AIR CUSHIONED VEHICLES Patent Application
Rodney S. Goering, inventor (to NASA) Filed 26 Jan. 1972 7 p
(NASA-Case-LAR-10256-1; US-Patent-Appl-SN-220785) Avail: NTIS CSCL 13F

The invention is comprised of a tubular guideway structure having open sides located on opposite sides of the structure, which function as a travel medium for high speed air-cushioned vehicles. The open sides of the tubular structure permit air to escape, thereby precluding a piston effect, and simultaneously provides for passenger viewing of the environment. Louvers may selectively be closed to protect the internal tubular structure from inclement weather conditions. NASA

N72-20254# Transportation Systems Center, Cambridge, Mass.
CHARACTERISTICS OF A SIGNAL DATA CONVERTER FOR A MULTI-RUNWAY VISIBILITY MEASURING SYSTEM Technical Report, Jun. - Nov. 1971
H. C. Ingrao and J. R. Lifsitz Oct. 1971 35 p refs
(DOT-TSC-FAA-72-1) Avail: NTIS

The signal data converter (SDC) is discussed in the context of an evolutionary growth of the visibility measuring system stemming from the present FAA RVR measuring technique. Included in outputs will be simultaneous signals from as many as nine transmissometers distributed three each along three runways. In addition, ground illuminance sensors will provide more background discrimination than the present day-night switch. The system will be expected to handle inputs from several kinds of target lights and to calculate several specialized visibility values (RVR,SVR,TVR). The SDC will be capable of modular expansion. Author

N72-20255# Transportation Systems Center, Cambridge, Mass.
PRELIMINARY SURVEY OF POTENTIAL STOL TERMINAL AREA OPERATIONAL REQUIREMENTS Interim Report
Lloyd E. Stevenson Jun. 1971 44 p refs
(DOT-TSC-FAA-71-9) Avail: NTIS

A preliminary survey of potential operational requirements for STOL in the terminal area has been made. The presentation of this survey is in three sections. The first section presents the motivation for the survey, which can be summarized as the necessity for the Federal Government to have a knowledge of the potential operational requirements of STOL. The second section discusses the markets in which STOL may be found viable. This discussion is limited to those aspects which are necessary to determine the effects of these markets on shaping future STOL operations. The final section consists of a description of terminal area operations as they currently exist, of possible operational changes that may occur exclusive of the introduction of STOL, and then of potential operational requirements of STOL in the terminal area. Author

N72-20256# Transportation Systems Center, Cambridge, Mass.
AN INVESTIGATION OF MICROWAVE LANDING GUIDANCE SYSTEM SIGNAL REQUIREMENTS FOR CONVENTIONALLY EQUIPPED CIVILIAN AIRCRAFT
Maurice H. Lanman, III Jun. 1971 184 p refs
(DOT-TSC-FAA-71-24) Avail: NTIS

Efforts are described leading to the determination of minimum suitable scan rates for the azimuth and elevation of a microwave landing guidance system (LGS), based on performance requirements of two conventionally equipped civilian aircraft. Two complementary methods are used, one involving a full nonlinear digital simulation, the other involving direct covariance matrix propagation. Wind and turbulence models, aircraft models and LGS models are described in detail. Safety and pilot acceptability criteria for performance evaluation are developed. Results are presented in terms of minimum scan rate maximum beam noise constraints. Limitations of the methods and data are also discussed. Author

N72-20257# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SPACE CHARGE EFFECTS IN PROTON LINEAR ACCELERATORS Ph.D. Thesis - Paris Univ.
Michel Prome Jul. 1971 190 p refs In FRENCH
(CEA-N-1457) Avail: AEC Depository Libraries

An attempt was made to explain the physical mechanisms which are responsible for space charge effects in a proton accelerator. The method chosen involves a numerical simulation of the beam. Computer programs describing beam dynamics with space charge effects are presented and are used to check results obtained elsewhere. A series of experiments was performed

demonstrating that coupling phenomena produce an equalization of r.m.s. velocities in the 3 directions. A new quantity (a sort of hyperemittance) is introduced and its growth between the input and output of a given linac is shown to be proportional to the beam intensity. Author (NSA)

N72-20258# Kernforschungszentrum, Karlsruhe (West Germany). Labor fuer Elektronik und Messtechnik.
HIGH-PEAK CURRENT FACILITY WITH 57 kWs
S. Jacobi, R. Schneider, and F. Will Mar. 1971 31 p refs In GERMAN; ENGLISH summary
(KFK-916) Avail: AEC Depository Libraries

A high-peak current facility is described for investigation of nuclear aerosols. It is designed to release electric power and energy to UO2 samples in such a way that reactor excursions can be simulated. The study of nuclear aerosols so produced is intended to help in clarifying questions of reactor safety technology. The facility was designed specifically for experimental use. The essential design data, such as stored energy (max 56 kWsec) and discharging time (60 to 180 microsec/half-wave) were made variable. In view of the high maximum charging voltage (18 kV) of the energy storage capacitors and the resulting maximum discharging current of 0.3 million A, considerable safety precautions were taken. Author (NSA)

N72-20259# European Organization for Nuclear Research, Geneva (Switzerland).
RADIATION PROBLEMS ENCOUNTERED IN THE DESIGN OF MULTI-GeV RESEARCH FACILITIES
K. Goebel, ed. 29 Sep. 1971 163 p refs
(CERN-71-21) Avail: AEC Depository Libraries

Topics include the requirements for radiation protection, the interaction of protons in machine components and beam loss distributions, hadronic and electromagnetic cascades, experimental methods, estimate of the hadronic cascade initiated by high-energy particles, shielding against muons, transmission along ducts and skyshine, induced radioactivity, radiation-induced damage to machine components and radiation heating, and remote-handling equipment and its use in accelerators. NSA

N72-20260# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SEMICONDUCTOR CONTROL SYSTEM FOR THE 680 MeV JINR SYNCHROCYCLOTRON
V. I. Danilov, B. M. Marchenko, Yu. V. Maksimov, E. I. Rozanov, M. P. Sechenov, V. I. Smirnov, T. N. Tomilina, and A. V. Shes:ov 1971 16 p In RUSSIAN
(JINR-P9-5953) Avail: AEC Depository Libraries

A semiconductor control system is described for synchrocyclotron operation on standard acceleration schedules. A uniform intensity of the expanded beam during the course of 75% of the modulation period was obtained owing to the supply of a sawtooth shaped current to the voltage coils. Control was obtained with the coils assisted by the semiconductor control circuit. Author (NSA)

N72-20261# Lund Univ. (Sweden). Dept. of Physics.
BEAM MONITORING SYSTEM USED AT THE LUND ELECTRON SYNCHROTRON
G. Jariskog, D. Korder, and C. Larsson May 1970 20 p refs
(LUSY-7001) Avail: AEC Depository Libraries

A beam monitoring system using ionization chambers with integrators is described. Results obtained in calibrating a Wilson-type quantameter against an identical precalibrated quantameter are given Author (NSA)

N72-20262# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
SPECIAL FEATURES OF THE HIGH FREQUENCY SYSTEM OF A SYNCHROCYCLOTRON AT 1-GeV PROTON ENERGY
I. M. Roife and E. V. Seredenko 1970 19 p refs In RUSSIAN
(NP-19078) Avail: AEC Depository Libraries

Basic calculation results of the synchrocyclotron RF system are presented. Operation peculiarities of the dee circuit as a distributed oscillating system are estimated. A formula is given of equivalent induction, taking account of the rotating capacitor connection at a narrow section of the dee. The effect of the rotating capacitor asymmetry is investigated. The basic peculiarities of the variator scheme are described. Possibilities of exciting and suppressing the parasite types of oscillations are discussed. Author (NSA)

N72-20263# Rutherford High Energy Lab., Chilton (England).
A SUPERCONDUCTING SYNCHROTRON DESIGN STUDY AT THE RUTHERFORD LABORATORY
M. H. R. Donald, M. R. Harold, N. M. King, B. G. Loach, J. R. M. Maidment, C. W. Planner, G. H. Rees, and J. V. Trotman Feb. 1971 13 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1-3 Mar. 1971
(RPP/N-23; Conf-710308-20) Avail: AEC Depository Libraries

Design features of a superconducting synchrotron to replace Nimrod are outlined. Constraints imposed by existing accelerator buildings and plant determine many of the parameters. The separated-function doublet lattice has 20 focusing periods, with 4 long straight sections created by omitting bending magnets from the appropriate periods. Author (NSA)

N72-20264# Sandia Labs., Livermore, Calif.
THE SLL FIRING FACILITY DATA ACQUISITION PROBLEMS AND THEIR SOLUTIONS
F. R. Dalrymple Nov. 1971 20 p
(SCL-DR-71-0336) Avail: NTIS

Problem areas in the data acquisition system were studied. The factors most apt to affect the data accuracy were found to be: (1) oscilloscope accuracy, (2) calibration equipment, (3) method of calibration, and (4) delay lines and patch cables.
Author

N72-20265# California Univ., Livermore. Lawrence Radiation Lab.
ASTRON MECHANICAL ENGINEERING EFFORT
C. A. Hurley, R. H. Bulmer, and S. M. Hibbs 20 Apr. 1971 13 p refs Presented at 4th Symp. on Eng. Probl. of Fusion Res., Washington, D. C., 20-23 Apr. 1971
(UCRL-73059; Conf-710418-4) Avail: NTIS

The two major components of the Astron machine, namely, the accelerator and main chamber, were modified. In two successive steps, the accelerator was increased in energy from 4 to 5 MeV, and then from 5 to 6 MeV, with a final beam current of approximately 800 A. This increased energy required a major modification to the radiation shielding. Additional hardware and refined diagnostics were added to the accelerator to improve its performance. Among these is a unique on-line energy analyzer, a 60-MHz rf modulator, a new method for measuring current and beam position, and the use of titanium to minimize sparking in the electron gun. Optimization of the beam transport included redesign of the solenoid magnets and the installation of a 65-ft-long continuous solenoid. Main-chamber changes included the repair and installation of both cantilevers with the addition of a device to bridge between the cantilevers. A method for quickly and accurately measuring the magnitude and configuration of the magnetic field for the main chamber solenoid is also described.
Author (NSA)

N72-20266# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
MODELING OF ENVIRONMENTAL PATHWAYS AND RADIATION DOSES FROM NUCLEAR FACILITIES
J. K. Soldat Oct. 1971 33 p refs Presented at 19th Conf. on Remote Systems Technol., Miami Beach, Fla., 17 Oct. 1971
(Contract AT(45-1)-1830)
(BNWL-SA-3939; Conf-711008-4) Avail: NTIS

A computer model was developed that calculates total

annual radiation doses and 50-year dose commitments to several categories of persons at population centers and combines these calculated doses into integrated (man-rem) annual and 50-year doses for large populations. The dose model was designed as one portion of an overall computer program developed to delineate the nuclear facilities expected in the year 2000, the radionuclides released to air and water, their diffusion, dispersion, and reconcentration in the environment, and the resulting radiation doses to people. Equations for calculating dose factors were derived. Effective decay energies for various radionuclides were calculated from the model, which assumes that all the radionuclide is in the center of a spherical organ with an appropriate effective radius. Author (NSA)

N72-20267# Los Alamos Scientific Lab., N.Mex.
THE I SUB 1,0 COIL SYSTEM FOR SCYLLAC AND SCYLLA 4
W. H. Borkenhagen, W. R. Ellis, H. W. Harris, and E. L. Zimmerman Oct. 1971 12 p refs
(Contract W-7405-eng-36)
(LA-4815) Avail: NTIS

The system of auxiliary 1 = 1 and 1 = 0 coils for the Scyllac and Scylla 4 theta-pinch experiments is described in detail, including theory of operation, design constraints, voltage and current requirements, methods of fabrication and testing, and external electrical circuits. These coils produce magnetic fields of the general form sin (1 theta-hz) which, when added to the axial theta-pinch field B sub 0, provide toroidal equilibrium for the plasma column and a means of feedback stabilization. Because these coils are subjected to both induced and applied voltages, the major engineering effort was directed toward achieving adequate electrical insulation in the limited space demanded by the low-inductance circuitry. Sophisticated epoxy potting, taping and spacing techniques were required. DC and pulsed voltage tests to above 100 kV were conducted prior to installation of the coils on the experiments. Electrical connections are made outside the theta-pinch coil in such a way as to cancel the induced voltages before they can reach the driving capacitor banks. Author (NSA)

N72-20268# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAS BARBER'S POINT, HAWAII
H. Tomita and L. J. Woloszynski Oct. 1971 94 p refs
(AD-735105; NCEL-TN-1198) Avail: NTIS CSCL 13/2

The results of a condition survey of the airfield pavements at the USNAS Barbers Point, Hawaii are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and Portland cement concrete pavement coverage of defect tapes, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-20269 National Lending Library for Science and Technology, Boston Spa (England).
ON ANOMALOUS PITOT TUBE READINGS IN INHOMOGENEOUS LIQUIDS
V. N. Kalashnikov and A. M. Kudin Jan. 1972 19 p refs Transl. into ENGLISH of Russian Inst. of Probl. of Mech. Preprint no. 6, Moscow, 1971
(NLL-BR-30068; NLL-DRIC-Trans-2640-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

An anomalous reduction in pitot tube readings in suspensions of hard particles was established experimentally. A universal relationship was obtained, connecting the defect in pitot tube readings with its dimensions, the diameter of particles, the velocity of flow and the volume concentration of particles. Author

N72-20270 National Lending Library for Science and Technology, Boston Spa (England).
THE LAW FOR VARIATION IN THE VELOCITY OVER THE TRANSVERSE SECTION OF A FREE CIRCULAR JET SPREADING IN A MEDIUM WITH A DIFFERENT DENSITY
Yu. Ya. Abramenkov and I. D. Semikin [1971] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 10, 1971 p 136-140
(NLL-M-21265-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of the ratio (rho sub med)/rho sub 1 on the velocity distribution was studied for cross sections of a free axisymmetric jet. An equation was obtained for velocity distribution. Author

N72-20271*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
FLOW FIELD MEASUREMENTS FOR CYLINDRICAL CONFIGURATIONS IN A HYPERSONIC WIND TUNNEL: WINDWARD AND LEEWARD FLOW FIELDS
John J. Bertin, J. Parker Lamb, Kathy R. Center, and Bruce W. Graumann Dec. 1971 76 p refs
(Contract NAS9-10976)
(NASA-CR-115467; Rept-71007) Avail: NTIS CSCL 20D

Windward and leeward measurements were made for a variety of simulated infinite cylinders exposed to hypersonic streams over an angle of attack from 30 deg to 90 deg. For the range of conditions included in the study, the following conclusions are made: (1) Swept cylinder theory provides a reasonable correlation of the measured laminar heat transfer rates from the plane of symmetry. (2) The boundary layer transition criteria in the plane of symmetry are a function of the transverse curvature. (3) Relaminarization of the circumferential boundary layer for a right circular cylinder was observed at the highest Reynolds number tested. (4) The effect of leeside geometry on the average heat transfer rate can be correlated with a single geometric parameter which is dependent on the location of separation. (5) The relationship of leeward heating to angle of attack is virtually linear for each cross section. (6) No systematic effect of free stream Reynolds number was observed. Author

N72-20272*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A STUDY OF INTERNAL DRAG OF SMALL-SCALE DUCTS AT MACH NUMBER 4
Lawrence A. Graham and Lynn W. Hunton Mar. 1972 64 p refs
(NASA-TM-X-62143) Avail: NTIS CSCL 20D

An experimental investigation was made to examine the applicability of methods used to determine internal drag of small ducts and to study some of the problems encountered in assessing momentum losses in such ducts. Test Mach numbers ranged from 3.7 to 4.4 at angles of attack of 0 and 5 degrees and at a constant Reynolds number of 4.3 million per foot. The configurations represented small ducts used to simulate external aerodynamics of air breathing propulsion systems and consisted of wing nacelle models of ducts with circular, square, and rectangular inlets and with a two-dimensional inlet. Author

N72-20273# Advisory Group for Aerospace Research and Development, Paris (France).
TURBULENT SHEAR FLOWS
Jan. 1972 506 p refs Presented at the Fluid Dyn. Panel

Specialists Meeting, London, 13-15 Sep. 1971
(AGARD-CP-93) Avail: NTIS HC $6.00/MF $0.95

Turbulent shear flows such as boundary layers, jets, and wakes, were investigated for nonreacting gas flow. Factors considered were the basic structure of equilibrium shear flows and the influence of compressibility, pressure gradients, surface curvature, three-dimensional flows, noise, density, and/or temperature gradients. For individual titles, see N72-20274 through N72-20307.

N72-20274# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

VARIATIONS ON A THEME OF PRANDTL

Peter Bradshaw *In* AGARD Turbulent Shear Flows Jan. 1972 10 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

Varieties of complex turbulent flow which are important in engineering are recognized as perturbations of classical thin shear layers to which Prandtl's approximation applies. The types distinguished are: (1) shear layers, (2) shear layers perturbed by small additional strain rates which produce appreciable changes in turbulence, and (3) shear layers perturbed by large additional strain rates. Examples are airfoil boundary layers merging into a wake, boundary layers on curved surfaces, and reattaching shear layers. The essential phenomena of these turbulent flows are discussed, and it is concluded that a program of turbulence measurement should enable calculation methods to be extended to a wide range of complex flows. A discussion of the general types of calculation methods suitable for complex flows is included. Author

N72-20275# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

STRUCTURE OF THE REYNOLDS STRESS NEAR THE WALL

W. W. Willmarth and S. S. Lu *In* AGARD Turbulent Shear Flows Jan. 1972 20 p refs (See N72-20273 11-12)
(Contract N00014-67-A-0181-0015)
Avail: NTIS HC $6.00/MF $0.95

Experimental studies are reported on the flow field near the wall in a turbulent boundary layer using hot wire probes. Measurements of the product uv were made using conditional sampling and with the aid of a digital computer. The criterion used to determine when uv was to be sampled was when streamwise velocity at the edge of the sublayer had attained a certain value. It was found that 60% of the contribution to uv occurred when the sublayer velocity was lower than mean velocity. Measurements involving correlation of truncated u and v signals revealed that the largest portion of Reynolds stress and turbulent energy components occurs when $u < 0$, $v > 0$, or during an intense bursting process; the remainder occur during recovery. Contributions to the production of turbulence and Reynolds stress at a point near the wall are of large magnitude, short duration, and intermittent. A rough measure of the intermittency factor for uv is 0.55. Author

N72-20276# Aix-Marseilles Univ. (France). Inst. de Mecanique Statistique de la Turbulence.

SPECTRAL DISTRIBUTIONS OF THERMAL FLUCTUATIONS IN A TURBULENT BOUNDARY LAYER [REPARTITIONS SPECTRALES DES FLUCTUATIONS THERMIQUES DANS UNE COUCHE LIMITE TURBULENTE]

L. Fulachier and R. Dumas *In* AGARD Turbulent Shear Flows Jan. 1972 10 p refs In FRENCH; ENGLISH summary (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

Temperature fluctuation spectra and spectral distributions of temperature velocity were measured in a turbulent boundary layer on a heated flat plate. The method of fluctuation diagramming was used for frequency-filtered signals in order to measure spectral correlation distribution. A comparison of thermal spectra and three velocity components is presented from the internal zone as far as the edge of the boundary layer. Balance equations are given for spectral distributions relative to temperature and the sum Q(n) for the spectra of the velocity components. Spectral distributions of production terms and molecular dissipation are also considered. Author

N72-20277# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.

INTERMITTENT STRUCTURES IN TURBULENT BOUNDARY LAYERS

R. F. Blackwelder and R. E. Kaplan *In* AGARD Turbulent Shear Flows Jan. 1972 7 p refs (See N72-20273 11-12)
(Grants NSF GK-24578; NSF GK-27800)
Avail: NTIS HC $6.00/MF $0.95

The intermittent structure in the outer region and the occurrence of intermittent bursts near the wall were investigated. The extent of these structures is characterized by the existence of streamwise momentum defects. Correlations suggest a connection between bursting that occurs in the wall region and the intermittent bulges of turbulence that protrude from the outer reaches of the turbulent boundary layer. A scheme is presented for the detection of turbulent bursts near the wall. Conditional averaging showed that during the burst there was a substantial streamwise momentum defect followed by an extremely rapid acceleration. The measurements suggest that perhaps a local instability is the source of the break-up of the wall flow. Author

N72-20278# Technische Univ., Berlin (West Germany). Inst. fuer Ueberschall Technik.

AN INTEGRAL METHOD FOR APPROXIMATE CALCULATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS WITH STREAMWISE PRESSURE GRADIENT

H.-J. Kuester *In* AGARD Turbulent Shear Flows Jan. 1972 20 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

An approach is presented for the transformation function sigma sub x which avoids both sublayer and substructure hypotheses of compressible turbulent boundary layers. Agreement between theory and experiment was obtained using a modification of skin friction principles. Thermodynamic behavior is approximately described by a modified Crocco integral which accounts for non-unit Prandtl number, and variable pressure and/or wall temperature. The boundary layer parameters of the transformed flow were calculated by a method based on the integral equations for momentum and mechanical energy. The calculation method was applied to a variety of turbulent boundary layers with and without pressure gradient. Author

N72-20279# Rhode Island Univ., Kingston.

A SIMPLE ANALYSIS OF TWO DIMENSIONAL TURBULENT SKIN FRICTION WITH ARBITRARY WALL AND FREE-STREAM CONDITIONS

Frank M. White and George H. Christoph *In* AGARD Turbulent Shear Flows Jan. 1972 10 p refs Supported by the AF (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

An approach is proposed for an approximate analysis of the two-dimensional turbulent boundary layer under a wide variety of arbitrary conditions. An effective formula is developed for the law-of-the wall which accounts for all of the different parameters considered. The wall law is combined with the differential momentum equation into a single first-order ordinary differential equation for the skin friction coefficient, suitable for computer or graphical solution and, in special cases, closed form solutions. Examples are given covering combinations of eight different effects: pressure gradient, heat transfer, compressibility, roughness, wall transpiration, transverse curvature, longitudinal curvature, and aqueous polymer solutions. The results indicate that the theory is not only the simplest existing analysis of the turbulent boundary layer but one of the most accurate. Author

N72-20280# Karlsruhe Univ. (West Germany).
AN EDDY VISCOSITY BASED ON THE SECOND PRINCIPAL INVARIANT OF THE DEFORMATION TENSOR
Willi Schoenauer *In* AGARD Turbulent Shear Flows Jan. 1972 10 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

Equations were derived for the time mean values of incompressible turbulent flow. The stress tensor was considered to be a function of the deformation tensor. The assumption of spatial homogenity and isotropy led to eddy viscosity dependence on the second principal invariant of the deformation tensor. The eddy viscosity function contains empirical coefficients which must be determined from measurements of turbulent equilibrium flows. Nonequilibrium flows were then described by relaxation equations. Equations for the turbulent boundary layer were derived. The empirical coefficients of the eddy viscosity function were determined for flat plate flow. Author

N72-20281*# Virginia Polytechnic Inst., Blacksburg. Dept. of Aerospace Engineering.
EFFECTS OF STRONG AXIAL PRESSURE GRADIENTS ON TURBULENT BOUNDARY LAYER FLOWS
Clark H. Lewis, E. W. Miner, and E. C. Anderson *In* AGARD Turbulent Shear Flows Jan. 1972 14 p refs (See N72-20273 11-12)
(Contract NAS1-9337)
(NASA-CR-125903) Avail: NTIS CSCL 20D

Comparisons are made between predictions for nonreacting turbulent boundary layer flow using a finite difference method, and integral methods used to predict compressible turbulent flows with pressure gradient and wall heat transfer. Both rocket and hypersonic aerodynamic wind tunnel nozzles are considered. Cooled and heated walls were studied. Van Dries and Reichardt's models were considered in a two-layer eddy viscosity scheme. Under heated wall conditions (i.e. wall temperature greater than the adiabatic wall temperature), strong coupling effects were found between wall heating and axial pressure gradients. For cooled wall conditions, predictions of velocity and temperature profiles downstream from regions of strong favorable pressure gradients were in good agreement with limited experimental profile data. Limitations in the use of boundary layer transformations for heated wall flows are presented. A computer program was developed to predict nonreacting and equilibrium chemically reacting laminar and/or turbulent boundary layer flows for internal (nozzle) and external two-dimensional and axisymmetric flows. Author

N72-20282# Instituto Superior Tecnico, Lisbon (Portugal).
MACH NUMBER EFFECTS IN TURBULENT FLOW
J. J. D. Domingos *In* AGARD Turbulent Shear Flows Jan. 1972 10 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

Starting from fundamental assumptions of microscopic thermodynamics and continuum mechanics, the existence of a velocity potential for the flow of viscous fluids was proved as a general property. The implications are discussed and the role of compressibility as an essential feature of turbulence, either in subsonic or supersonic flows, is stressed. The apparently contradictory consequence of zero vorticity in flows which are derived from a potential is clarified through a discussion of concepts implicitly assumed in the usual definitions of mean density, mean velocity, and thermodynamic equations of state. The results are applicable to general supersonic viscous flows, because the theory is concerned with instantaneous velocity fields, without separation into mean and turbulent quantities. The solutions found are asymptotically exact solutions of the time-dependent three-dimensional Navier-Stokes equations for a viscous and compressible fluid which follows a polytropic evolution. Author

N72-20283# Avco Corp., Wilmington, Mass. Avco Systems Div.
A TWO LAYER MODEL OF HIGH SPEED, THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS AND SUPERCRITICAL BOUNDARY LAYER INVISCID FLOW INTERACTIONS
Barry L. Reeves *In* AGARD Turbulent Shear Flows Jan. 1972 21 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

A two-layer model of the three-dimensional compressible turbulent boundary layer was developed which is applicable to flows with pressure gradient and surface mass transfer. The model is based on the small cross flow approximation in which the spreading metric is determined by the inviscid streamline pattern. A modified Mangler transformation was employed which permits transformation of the boundary layer equations to a two-dimensional form without transforming the turbulent stress or heat flux. The computational speed of the method is rapid enough to enable equations for the inviscid stream deflection to be coupled with method used for calculations of strong (supercritical) interactions, such as in the region downstream of the critical point in reattaching flows or in regions of strong blowing. Solution of the inner (wall) layer for the velocity, enthalpy, stress and heat flux was obtained using mixing length theory and the thin layer Couette model. This solution led to a generalized compressible law of the wall with mass injection. In the outer wake layer an integral moment method was used along with appropriate matching conditions with the inner layer. Several solutions and experimental comparisons are presented. Results are also presented for relaxing flows where C sub f and (2C sub H)/C sub f initially are far from their equilibrium values. Author

N72-20284# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF AN IMPROVED MIXING LENGTH MODEL TO THE STUDY OF THREE DIMENSIONAL BOUNDARY LAYERS [APPLICATION D'UN SCHEMA AMELIORE DE LONGUEUR DE MELANGE A L'ETUDE DES COUCHES LIMITES TURBULENTES TRIDIMENSIONNELLES]
J. Cousteix, C. Quemard, and R. Michel *In* AGARD Turbulent Shear Flows Jan. 1972 11 p refs In FRENCH; ENGLISH summary (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

An improved mixing-length model, previously applied to two-dimensional flow, is extended to cover the three-dimensional case, relying on the assumption that the turbulent shear stress acts in the same direction as the laminar. It is used to work out similar solutions to the local equations of a turbulent boundary layer with small cross-flow. In a compressible fluid with arbitrary pressure gradients, a digital routine enables sets of transverse and longitudinal boundary-layer profiles and the wall skin-friction components to be determined as a function of tow parameters expressing the influence of pressure gradients. A comparison with experimental results shows a measure of agreement. The model offers the requisite hypotheses on which to build an integral method of computing three-dimensional turbulent boundary layers. Author

N72-20285# National Aerospace Lab., Amsterdam (Netherlands).
A CALCULATION METHOD FOR THREE DIMENSIONAL INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS
P. Wesseling and J. P. F. Lindhout *In* AGARD Turbulent Shear Flows Jan. 1972 13 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

A system of partial differential equations which can be used as a mathematical model for three-dimensional incompressible turbulent boundary layers is discussed. Certain mathematical properties of these equations are elucidated. The equations have a finite domain of dependence; this fact simplifies the problem of calculating three-dimensional boundary layer flows. The equations are solved numerically by means of a simple linear explicit finite difference scheme. The choice of an efficient difference scheme is guided by two criteria for the stability of linear difference schemes with constant coefficients. The method is used to calculate several experimental flows. Author

N72-20286*# Aeronautical Research Associates of Princeton, Inc., N.J.
A PROGRESS REPORT ON THE ATTEMPT TO CONSTRUCT AN INVARIANT MODEL OF TURBULENT SHEAR FLOWS
Coleman duP. Donaldson *In* AGARD Turbulent Shear Flows Jan. 1972 24 p refs (See N72-20273 11-12)
(Contract NASw-1868)
(NASA-CR-125904) Avail: NTIS CSCL 20D

The results of comparing computations using a tentative model of turbulent shear flows with experimental data are presented for the axially symmetric free jet, the two-dimensional free shear layer, and the flat plate boundary layer. The need for more carefully designed and documented free turbulent flow measurements is discussed in relation to the problem of selecting more refined models. Some observations are also made concerning the application of double correlation closure schemes to the computation of turbulent flows other than classical incompressible shear layers. In particular, the possibility of other methods of calculating the behavior of chemically reacting turbulent flows is examined. Author

N72-20287# Delaware Univ., Newark.
A RE-EVALUATION OF ZERO PRESSURE GRADIENT COMPRESSIBLE TURBULENT BOUNDARY LAYER MEASUREMENTS
James E. Danberg *In* AGARD Turbulent Shear Flows Jan. 1972 11 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

Compressible turbulent boundary layer velocity and temperature profiles with zero pressure gradient were collected and prepared for computer analysis. An assumed equation for these profiles was chosen allowing four constants to be adjusted by a nonlinear least squares technique. The four constants are: a velocity scale, boundary layer thickness, the constant of the semi-log region and the wake constant. This equation is analogous to Cole's incompressible law of the wall and wake but uses a generalized velocity to account for compressibility. Measurements from 45 adiabatic wall tests were analyzed covering a Mach number range from 2 to 6. Of these profiles, 29 included skin friction balance data which allowed direct evaluation of the universal constant of turbulence (mean value of k = .43) through comparison between the shear velocity and the profile velocity scale. The constants of the semi-log and the wake region were found to be independent of Reynolds and Mach numbers. A similar analysis was carried out for the limited number of total temperature profiles. Author

N72-20288# Royal Aircraft Establishment, Bedford (England).
SOME BOUNDARY LAYER MEASUREMENTS ON A FLAT PLATE AT MACH NUMBERS FROM 2.5 TO 4.5
D. G. Mabey, H. U. Meier (Deutsche Forschungs-und Versuchsanstalt fuer Luft und Raumfahrt, Goettinger), and W. G. Sawyer *In* AGARD Turbulent Shear Flow Jan. 1972 11p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

An experimental investigation of the turbulent boundary layer on a large, thermally insulated flat plate is reported, in which Mach number and total temperature profiles and shear stress at the wall were measured. The measured velocity profiles are found to be in good agreement with theoretical treatments. Similarly, the measured skin-friction coefficients are predicted flat-plate skin-friction laws. The form of the total temperature profile close to the wall suggests an increase in turbulent Prandtl number as the wall is approached. At all conditions, the wall temperature was found to be higher than would be expected in adiabatic flow conditions, while there was a substantial deficit of enthalpy flux within the boundary layer. Author

N72-20289# National Aeronautical Establishment, Ottawa (Ontario).
COMPARISONS BETWEEN SOME HIGH REYNOLDS NUMBER TURBULENT BOUNDARY LAYER EXPERIMENTS AT MACH 4, AND VARIOUS RECENT CALCULATION PROCEDURES
D. J. Peake, G. Brakmann (McGill Univ.), and J. M. Romeskie (McGill Univ.) *In* AGARD Turbulent Shear Flows Jan. 1972 70 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

The objective was to assess the influence of streamwise pressure gradients upon two-dimensional compressible turbulent boundary layers at high Reynolds numbers, in the absence of end-wall effects and longitudinal curvature effects. Boundary layers recovering to equilibrium conditions were emphasized. Measurements were made at a Mach 4 of pressure distribution, local skin friction, and boundary-layer profiles along the internal surface of a parallel, circular cross-section duct. The Reynolds number based on the duct length of 33-inches was almost 50 million. Results from three experiments are presented, namely a near zero pressure gradient flow, an adverse pressure gradient case, and a flow relaxing downstream of a step-induced separation. The boundary layer predictions of all the methods were in reasonable agreement with experiment. The outstanding exception was the discrepancy observed between the calculated and experimental skin friction results in the adverse pressure gradient flow, which was attributed tentatively to the static pressure gradient across the boundary layer in the region of the streamwise pressure increase. Author

N72-20290# Johns Hopkins Univ., Baltimore, Md.
THE STRUCTURE OF TURBULENCE IN SHEAR FLOWS
Leslie S. G. Kovasznay *In* AGARD Turbulent Shear Flows Jan. 1972 14 p refs (See N72-20273 11-12)
(Contract F44620-69-C-0023)
Avail: NTIS HC $6.00/MF $0.95

Results obtained by flow visualization techniques have given inspiration for devising plausible models rather than have provided numerical data to be compared with experiments. Hot-wire anemometer records, especially by employing appropriate signal processing techniques have given quantitative data that can be used for direct comparison with theoretical predictions. Theoretical possibilities are reviewed, and arguments are presented for favoring a model consisting of random sprinkled, but deterministic flow structures against models based on travelling waves. A suggestion for a possible form of mean flow predictions schemes is outlined. Author

N72-20291# ARO, Inc., Arnold Air Force Station, Tenn.
FREE TURBULENT MIXING: A CRITICAL EVALUATION OF THEORY AND EXPERIMENT
Philip T. Harsha *In* AGARD Turbulent Shear Flows Jan. 1972 11 p refs (See N72-20273 11-12)
(Contract F40600-71-C-0002; AF Proj. 9711)
Avail: NTIS HC $6.00/MF $0.95

A group of models for the turbulent shear stress, ranging from the classical Prandtl mixing length theory to the kinetic energy models, are systematically confronted with a broad range of experimental data. Two sets are developed: (1) those models suitable for engineering use, and (2) the models which show promise of becoming applicable with further development to turbulent free mixing. Author

N72-20292# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
JET TURBULENCE: DISSIPATION RATE MEASUREMENTS AND CORRELATIONS
Carl A. Friehe, C. W. VanAtta, and Carl H. Gibson *In* AGARD Turbulent Shear Flows Jan. 1972 7 p refs (See N72-20273 11-12)
(Contract F44620-68-C-0010; Proj. THEMIS)
Avail: NTIS HC $6.00/MF $0.95

A correlation of the mean rate of dissipation on the center-line in terms of the orifice Reynolds number and axial position is established. Measurements of the velocity and velocity derivative are described for a jet of orifice Reynolds number of 1.2 x 10 to the 5th power. The spectrum of the square of the velocity derivative was found to be similar to those

obtained for atmospheric boundary layer flows at very large Reynolds numbers when normalized with Kolmogoroff length and time scales. Spectra of higher order moments of the velocity derivative are also presented and compared to Novikov's predictions of the power law subranges. Author

N72-20293# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).

VELOCITY AND DENSITY MEASUREMENTS IN A FREE JET

O. H. Wehrmann *In* AGARD Turbulent Shear Flows Jan. 1972 9 p refs (See N72-20273 11-12)

Avail: NTIS HC $6.00/MF $0.95

The fluctuating properties in a turbulent flow are due to convection, diffusion, production, dissipation, and pressure transport. To perform an energy balance, not only velocity terms have to be measured, but also the pressure or density components of the pressure transport term. Velocity fluctuations can be measured by the hot-wire technique; in contrast to this, the local measurement of the density fluctuations presents a certain problem, especially if the disturbance of the flow field by a density measuring would have to be kept as small as possible. To obtain a local measurement, a focussed laser beam Mach-Zehnder interferometer was used. The flow measurements were made for the flow field behind a 2.5 cm nozzle at a flow velocity of 43 m/sec. The flow in the center of the nozzle at the exit plane was laminar or made turbulent by the insertion of a screen. Author

N72-20294# Technical Univ. of Denmark, Lyngby. Dept. of Fluid Mechanics.

AN EXPERIMENTAL INVESTIGATION OF CURVED TWO DIMENSIONAL TURBULENT JETS

C. Schwartzbach *In* AGARD Turbulent Shear Flows Jan. 1972 12 p refs (See N72-20273 11-12)

Avail: NTIS HC $6.00/MF $0.95

Hot-wire measurements of mean velocity and normal turbulent stress in the direction of flow are presented for the flow field generated by a plane jet reattaching to a flat plate adjacent to the jet nozzle. Measurements were made in longitudinal and lateral traverses of the curved jet flow and in the two wall jet flows. Measurements were made in two series for thirteen different positions of the adjacent plate thereby providing data for differing values of jet curvature and jet pathlengths. Integral methods were used on the experimental data to evaluate the effect of jet curvature on the entrainment along the external and internal boundaries of the curved jet. Author

N72-20295# California Inst. of Tech., Pasadena.

THE EFFECT OF DENSITY DIFFERENCE ON THE TURBULENT MIXING LAYER

Garry V. Brown and Anatol Roshko *In* AGARD Turbulent Shear Flows Jan. 1972 12 p refs Supported by ONR (See N72-20273 11-12)

Avail: NTIS HC $6.00/MF $0.95

An experimental study was made of the turbulent mixing layer between two streams of different gases, especially nitrogen and helium. This was made in a flow apparatus, designed to produce good quality flow at pressures up to 10 atmospheres with run times as low as 1 or 2 seconds. High-speed measurement techniques, including a density probe, were used. Shadowgraphs of the turbulent mixing layer reveal a large-scale structure similar to that in the late stages of instability development in a laminar free shear layer. The similarity properties of the mixing layers are established from profiles of mean velocity and density, and from these the basic flow parameters are computed; spreading rate, dissipation rate, shear stress distribution. It is found that a large density ratio (e.g., 7:1) in the two streams does not have a great effect on the spreading rate; this contrasts with the large effect of Mach number on the turbulent spreading of a free shear layer at the edge of a supersonic flow. A brief analysis compares the effects of density nonuniformities in low speed flow and those due to compressibility at high Mach number. Author

N72-20296# Defence Research Establishment Valcartier (Quebec).

FLUID DYNAMIC PROPERTIES OF TURBULENT WAKES OF HYPERSONIC SPHERES

J. G. G. Dionne, D. Heckman, C. Lahaye, L. Sevigny, and L. Tardif *In* AGARD Turbulent Shear Flows Jan. 1972 13 p refs (See N72-20273 11-12)

(ARPA Order 133)

Avail: NTIS HC $6.00/MF $0.95

Representative data, concerning the mean behavior of velocity and density in the wakes of hypersonic spheres launched at Mach 13 and a pressure times sphere density of 20 torr-inches, are given. The variation with axial distance of the velocity, density, and temperature defects and of the velocity and density wake radii are given and are compared with other similar data and with schlieren data obtained under the same conditions. Data on turbulent characteristics such as velocity fluctuations, ionization scale lengths and wake intermittency are also given. Finally, the total momentum in the wake is estimated from the measured velocity and mass density distributions. Author

N72-20297# Avco-Everett Research Lab., Everett, Mass.

MEASUREMENTS OF THE INSTANTANEOUS SPATIAL DISTRIBUTION OF A PASSIVE SCALAR IN AN AXISYMMETRIC TURBULENT WAKE

Arthur M. Schneiderman *In* AGARD Turbulent Shear Flows Jan. 1972 12 p refs (See N72-20273 11-12)

(Contract F04701-70-C-0128)

Avail: NTIS HC $6.00/MF $0.95

The spatial mixing field in the turbulent wake of a longitudinally aligned truncated cylinder at a Mach number of 2.5 and a Reynolds number of 1 million (based on diameter) is observed experimentally using the laser planogram technique. The instantaneous spatial distribution of a tracer material introduced at the model is characterized statistically by estimates of the probability density function, energy spectrum and autocovariance coefficient of the measured fluctuations. Wake axis measurements over the region from 138 to 182 body diameters yield turbulent concentration fluctuations of 25% and skewness and kurtosis of +0.18 and +0.16, respectively. A centerline intermittency of approximately 82% is observed. A classical turbulence spectrum with a well defined break from a flat to a k to the minus 5/3 power inertial subrange is found. The autocovariance coefficient yields a macroscale which is approximately half the transverse scale length. The wake boundary is observed to be substantially more contorted than had previously been suspected. Author

N72-20298# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

RECENT ATTEMPTS TO DEVELOP A GENERALLY APPLICABLE CALCULATION METHOD FOR TURBULENT SHEAR FLOW LAYERS

J. C. Rotta *In* AGARD Turbulent Shear Flows Jan. 1972 11 p refs (See N72-20273 11-12)

Avail: NTIS HC $6.00/MF $0.95

Calculation methods are discussed, which are based on the differential equations for the Reynolds stresses. The considerations restrict themselves to two-dimensional flow fields, for which the usual boundary layer approximations apply. In many of the proposed methods of this kind, the equation for the kinetic fluctuation energy plays a central role. The transport equation for the Reynolds shear stress includes as special cases Prandtl's eddy viscosity relation and Bradshaw's assumption of a constant ratio of shear stress to kinetic fluctuation energy. A differential equation for the integral length scale is derived from Navier-Stokes equations, and the closure assumptions are given. It turns out that the simplified version of the length scale equation, used by some authors, is not capable of reproducing the characteristics of different kinds of flows. The main reason for this shortcoming is found in an oversimplification of the turbulence production term of the length scale equation. The arguments are illustrated by calculated results. Author

N72-20299# Naval Ordnance Lab., White Oak, Md.
AN EXPERIMENTAL STUDY OF THE COMPRESSIBLE TURBULENT BOUNDARY LAYER WITH AN ADVERSE PRESSURE GRADIENT
Robert L. P. Voisinet, Roland E. Lee, and William J. Yanta *In* AGARD Turbulent Shear Flows Jan. 1972 10 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

The results of a detailed experimental investigation of the compressible turbulent boundary layer in an adverse-pressure-gradient regime are presented. The studies were conducted on a flat nozzle wall for Mach numbers between 4.1 and 4.9, at momentum thickness Reynolds numbers from 5800 to 69,000 and at wall-to-adiabatic-wall temperature ratios of 1.0 and 0.8. Complete and often redundant profile measurements were taken with Pitot and static-pressure probes and conical equilibrium and fine-wire temperature probes. The wall shear and surface heat transfer were measured directly with a skin-friction balance and a heat-transfer gage. The effect of the adverse-pressure-gradient flow on the boundary-layer flow structure, friction drag, and heat transfer, as compared with zero- and favorable-pressure-gradient flow, is discussed. A test showing the effect of nozzle throat cooling on the downstream boundary layer is also reported. This throat cooling caused significant changes in the downstream temperature profiles and recovery factor with no effect on the local wall shear. Author

N72-20300# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE SUPERSONIC TURBULENT BOUNDARY LAYER IN AN ADVERSE PRESSURE GRADIENT: EXPERIMENT AND DATA ANALYSIS
Walter B. Sturek and James E. Danberg (Delaware Univ., Newark) *In* AGARD Turbulent Shear Flows Jan. 1972 13 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

Experimental measurements of the profile characteristics of the supersonic turbulent boundary layer in a region of moderate adverse pressure gradient along a two-dimensional isentropic ramp model are reported. The data are for a closely adiabatic wall at a tunnel nozzle setting of M = 3.54. Detailed surveys of impact pressure, static pressure and total temperature were made, and wall shear stress was measured using the Preston tube technique. In addition to the mean profile data, fluctuation data were obtained using constant temperature hot-wire anemometry in the zero pressure gradient flow upstream of the ramp model and in the adverse pressure gradient flow along the ramp model. Turbulent boundary layer equations applicable to compressible flow over a surface with longitudinal curvature are analyzed. Corrections for longitudinal curvature to the equation for conservation of streamwise momentum are shown to be small and of the same order of magnitude as the contribution of the wall shear stress. The data are shown to correlate in law of the wall and velocity defect dimensionless coordinates using an integral compressibility transformation that follows directly from Prandtl's mixing length approximation of the Reynolds' stress. Eddy viscosity and mixing length distributions for the zero pressure gradient boundary layer were determined directly from the experimental data and agree qualitatively with previously published findings. The measured value of skin friction coefficient is 20 percent less for the flow over the ramp model than for the zero pressure gradient flow upstream. Author

N72-20301# Imperial Coll. of Science and Technology, London (England). Aeronautics Dept.
TURBULENT BOUNDARY LAYERS AT SUPERSONIC AND HYPERSONIC SPEEDS
G. T. Coleman, G. M. Elfstrom, and J. L. Stollery *In* AGARD Turbulent Shear Flows Jan. 1972 9 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

The growth of a compressible turbulent boundary layer over flat plate and compression corner models was studied at a Mach number of 9. Local Mach numbers between 3 and 9 were achieved on a flat plate by varying the incidence from 0 to 26.5 deg. The local unit Reynolds numbers used were between 150,000 and 700,000. The measurements, which include pressure and heat transfer rate distributions and pitot pressure profiles across the boundary layer, extend the range of existing data and are used to test some current prediction methods and to emphasize some features of lower Mach number flows. Heat transfer rate distributions at Mach numbers of 3, 5 and 9 show an increasing discrepancy between experiment and theory as the Mach number rises, the data being higher than the predicted value but approaching it asymptotically with increasing momentum thickness Reynolds number (Re theta). The boundary layer profiles taken at Mach 9 grew fuller as Re theta decreased; both of these results are associated with the slow development of the wake component of the turbulent boundary layer profile at high Mach numbers. Author

N72-20302# Queen Mary Coll., London (England).
AN EXPERIMENTAL INVESTIGATION OF THE TURBULENT BOUNDARY LAYER ALONG A STREAMWISE CORNER
O. O. Mojola and A. D. Young *In* AGARD Turbulent Shear Flows Jan. 9, 1972 9 p. refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

A selection of results are presented of an extensive experimental investigation of steady incompressible turbulent boundary layer along a smooth 90 degree streamwise corner, formed by a pair of identical intersecting flat plates, with the freestream velocity directed parallel to the cornerline. Detailed explorations of the flow, with and without external pressure gradients, included the determination of static pressure fields, the mean velocities, wall shear stresses, and the components of the Reynolds (turbulent) stress tensor. A secondary flow towards the corner along the plane of symmetry and outwards from it close to the walls forming the corner is a vital and characteristic feature and is clearly reflected in the mean and turbulence flow measurements. In particular, it modifies the relations between the shear stress components and turbulence energy and mean velocity distribution so as to make any simple extension of current methods of turbulent boundary layer prediction unlikely to be applicable in such a flow. Author

N72-20303# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INJECTION OF A TURBULENT BOUNDARY LAYER WALL WITH A STRANGE GAS [COUCHE LIMITE TURBULENTE AVEC INJECTION A LA PAROI D'UN MEME GAZ OU D'UN GAZ ETRANGER]
T. Lili and R. Michel *In* AGARD Turbulent Shear Flows Jan. 1972 10 p refs In FRENCH; ENGLISH summary (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

An improved mixing-length model is applied to the theoretical determination of a turbulent boundary layer, with transfer of fluid at the wall, and the results are compared point by point with available experimental evidence. In the incompressible field, there are first provided some solutions to the local equations of an equilibrium boundary layer, to define the requisite set of velocity profiles and skin friction law for an air injection with pressure gradient. Next, the velocity and concentration profiles are worked out for foreign gas injected. Lastly, the solution is extended to cover the general case of a compressible fluid, leading to a systematic set of results for the effect of injection upon skin-friction and heat transfer shown as a function of Mach number and wall temperature. Author

N72-20304# California Inst. of Tech., Pasadena.
A SURVEY OF DATA FOR TURBULENT BOUNDARY LAYERS WITH MASS TRANSFER
Donald Coles *In* AGARD Turbulent Shear Flows Jan. 1972 15 p refs (See N72-20273 11-12)
Avail: NTIS HC $6.00/MF $0.95

A critical survey is made of available experimental data on turbulent boundary layers with mass transfer in the absence of

complicating factors such as compressibility and pressure gradient. Two approaches to the data show particular promise. The first is the mixing-length approach, which leads (as is well known) to a set of modified coordinates such that the classical similarity laws outside the sublayer seem to remain valid down to the last detail, at least for moderate values of suction or blowing. The second approach is more original; it is an attempt to generalize the kind of analysis often used to develop similarity laws for free shear flows such as wakes or jets, while preserving intact an argument which extends these ideas to the case of boundary-layer glow. The essential step is the definition of a characteristic velocity (qua friction velocity) in terms of a characteristic stress (qua wall stress) which occurs somewhere in the layer. A strong precedent for such a step can be found in the usual treatment of surface roughness. So far, the best choice for the characteristic stress seems to be some kind of average value for the sublayer.

Author

N72-20305# Stanford Univ., Calif. Dept. of Mechanical Engineering.

THE SUPPRESSION OF SHEAR LAYER TURBULENCE IN ROTATING SYSTEMS

James P. Johnston *In* AGARD Turbulent Shear Flows Jan. 1972 9 p refs (See N72-20273 11-12)

(Grants NSF GK-2533; NSF GK-16450)

Avail: NTIS HC $6.00/MF $0.95

Stabilization of turbulent boundary layer type flows by the action of coriolis forces engendered by system rotating is studied. Experiments on fully-developed, two-dimensional flow in a long, straight channel that was rotated about an axis perpendicular to the plane of mean shear are reviewed to demonstrate the principle effects of stabilization. In particular, the delay of transition to turbulence on the stabilized side of the channel to high Reynolds number as the rotating number is increased is demonstrated. A simple method, that utilizes the eddy Reynolds number criterion of Bradshaw, is employed to show that rotating induced suppression of transition may be predicted for the channel flow case. The applicability of the predictive method to boundary layer type flows is indicated.

Author

N72-20306# Lyon Univ. (France).

DEVELOPMENT OF A TURBULENT BOUNDARY LAYER ON A FLAT PLATE IN AN EXTERNAL TURBULENT FLOW

G. Charnay, G. Comte-bellot, and J. Mathieu *In* AGARD Turbulent Shear Flows Jan. 1972 9 p refs (See N72-20273 11-12)

Avail: NTIS HC $6.00/MF $0.95

The development of a turbulent boundary layer on a flat plate was experimentally investigated in the presence of an external turbulent flow generated by grids. With reference to a turbulent boundary layer evolving in an undisturbed flow the following results were observed when the external turbulence level is increasing: (1) the boundary layer grows more rapidly; (2) the wall shear stress is higher; (3) in the outer region of the layer the mean velocity profile becomes flatter and the law of the wake is modified. In the same region the turbulent levels are increased; and the turbulent shear stress and the turbulent kinetic energy production become larger. Various integral length scales of the external turbulent flow were also used. A discernable effect was observed on the integral scales of the boundary layer only. A rearrangement of the external isotropic turbulence, due to the straining process of the mean existing velocity gradient in the boundary layer is tentatively proposed.

Author

N72-20307# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

SOME MEASUREMENTS OF THE DISTORTION OF TURBULENCE APPROACHING A TWO DIMENSIONAL BODY

P. W. Bearman *In* AGARD Turbulent Shear Flows Jan. 1972 11 p refs (See N72-20273 11-12)

Avail: NTIS HC $6.00/MF $0.95

A description is given of the distortion of grid generated turbulence as it approaches the stagnation region of a two-dimensional body. When L sub x/D is much greater than 1, (where L sub x is the scale of turbulence and D is a typical body dimension), along the mean stagnation streamline, the longitudinal component of the velocity fluctuations attenuates like the mean flow. Whereas if L sub x/D is much less than 1 the turbulence is distorted by the mean flow field and the longitudinal component of the velocity fluctuations will be amplified due to the vortex stretching. When L sub x/D = O(1) a combination of these effects is found with attenuation of energy at low wave numbers and amplification at high wave numbers. Measurements of the pressure fluctuations at the stagnation point show that at low wave numbers the level of the pressure fluctuations can be predicted by assuming the turbulence to be irrotational. Author

N72-20308# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

CALCULATION OF UNSTEADY COMPRESSIBLE FLOWS INVOLVING SHOCKS

S. V. Patankar Dec. 1971 18 p refs

(UF/TN/A/4) Avail: NTIS

A numerical finite difference technique is presented for the solution of the hyperbolic equations that describe an unsteady compressible flow. The technique is an extension of a newly developed method for three-dimensional incompressible flows. The technique is described with reference to one-dimensional frictionless flow, but it may be generalized to multi-dimensional viscous flow. As an illustration, the shock tube problem is solved and the solutions are compared with available exact solutions.

Author

N72-20309# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON SOME EXPLICIT DIFFERENCE SCHEMES FOR THE HYDRODYNAMICS EQUATIONS

V. V. Gadzhieva and V. F. Kuropatenko [1971] 3 p ref Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz. (USSR), v. 11, no. 6, 1971 p 1603-1605

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is proposed for constructing explicit difference schemes for hydrodynamic equations without constraints on the spacing ratio. The numerical processes and mathematical models involved in the difference schemes are described. The stability of the difference scheme was verified by the method of harmonics in the acoustics case and by numerical analysis in the nonlinear case.

Author

N72-20310*# National Aeronautics and Space Administration, Washington, D.C.

THE TURBULENT BOUNDARY LAYER IN SUPERSONIC GAS FLOWS

Yu. V. Lapin Mar. 1972 292 p refs Transl. into ENGLISH of the book "Turbulentnyy Pogranichnyy Sloy v Sverkhzvukovykh Potakakh Gaza" Moscow, Nauka Press, 1970 344 p

(NASA-TT-F-691) Avail: NTIS CSCL 20D

The theoretical and experimental results of studies of pressure drop, heat, and mass transfer in turbulent boundary layers at supersonic gas velocities are discussed. The fundamentals of the molecular theory of gas flows, derivations of the equations of turbulent motion and of the boundary layer equations, in particular for the case of multicomponent reacting gases are presented. Information is given on the kinetics of chemical reactions, including the kinetics of dissociation reactions in air. Problems of heat and mass transfer on permeable surfaces are considered.

Author

N72-20311# Royal Aircraft Establishment, Farnborough (England).

THE APPLICABILITY OF THE GAS/SHALLOW-WATER ANALOGY IN QUANTITATIVE FORM TO FLOWS ABOUT

BLUNT BODIES
G. Niehus Feb. 1971 153 p refs Transl. into ENGLISH from "Die Anwendbarkeit der Gas-Flachwasser-Analogie in Quantitativer Form auf Stroemungen um Stumpfe Koerper", QFLR report FB-68-21
(RAE-Lib-Trans-1582; DFLR-FB-68-21; BR-28318) Avail: NTIS

An analogy of gas/shallow water relationship in a quantitative form is applied to the flow characteristics around blunt bodies. The advantages of the hydraulic analogy and the limitations of its applicability are discussed. The theoretical fundamentals and experimental procedures are explained. Air and free surface flows past bodies of interest in deceleration techniques are compared with the theory. Author

N72-20312# RAND Corp., Santa Monica, Calif.
THE DEFORMATION AND MASS LOSS OF LIQUID DROPS IN A HIGH SPEED FLOW OF GAS
R. Collins and A. F. Charwat Aug. 1971 36 p refs
(P-4685) Avail: NTIS

The deformation of a liquid drop placed suddenly into a uniform high speed gas flow is analyzed in terms of an approximation based on a nearly radial outward flow within the drop. The drop deforms into a lenticular elongated shape resembling a saucer, whose edges break off as they become progressively thinner. The mass loss appears to result principally from the growth of capillary surface waves originating at the stagnation point of the drop and growing in amplitude as they progress radially outward. It is proposed that mass is not lost continuously, but rather in discrete time increments as the drop shape reestablishes itself between successive separations of liquid from the drop. In terms of a dimensionless time based upon dynamic pressure, the solution is shown to depend explicitly upon two parameters, the gas/liquid density ratio (a weak function of Mach number) and the critical thickness parameter controlling mass loss. The results of the analysis agree well with experiments reported for freestream velocities appropriate to flow behind a normal shock wave of shock Mach number varying from 1.5 to 12. Author

N72-20313# RAND Corp., Santa Monica, Calif.
ON TWO-DIMENSIONAL TEMPERATURE MODELING
Joel S. Kvitky Oct. 1971 57 p refs
(P-4713) Avail: NTIS

The theoretical and practical framework for a two-dimensional temperature model is provided. The vertically integrated mass balance equations of the simulation model are discussed and shown to apply to temperature modeling. Terms contributing to the total heat flux across the water surface are described and approximated by empirical relations, which are integrated into the temperature model through an equilibrium temperature and heat exchange coefficient. The sensitivity of these parameters to the meteorological variables is discussed in the context of a preliminary calculation. Tables are given for the heat exchange coefficient and equilibrium temperature. Finally, expressions are derived for the relative isobaric slope as a function of chlorinity and temperature. Author

N72-20314# RAND Corp., Santa Monica, Calif.
A SURVEY OF DATA FOR TURBULENT BOUNDARY LAYERS WITH MASS TRANSFER
Donald Coles (Calif. Inst. of Technol.) Sep. 1971 18 p refs
(P-4697) Avail: NTIS

A critical survey is made of available experimental data on turbulent boundary layers with mass transfer in the absence of complicating factors such as compressibility and pressure gradient. Two approaches to the data show particular promise. The first is the mixing-length approach, which leads (as is well known) to a set of modified coordinates such that the classical similarity laws outside the sublayer seem to remain valid down to the last detail, at least for moderate values of suction or blowing. The second approach is more original; it is an attempt to generalize the kind of analysis often used to develop similarity laws for free shear flows such as wakes or jets, while preserving intact an argument which extends these ideas to the case of boundary-layer flow. The essential step is definition of a characteristic velocity (qua friction velocity) in terms of a characteristic stress (qua wall stress) which occurs somewhere in the layer. A strong precedent for such a step can be found in the usual treatment of surface roughness. So far, the best choice for the characteristic stress seems to be some kind of average value for the sublayer. Author

N72-20315# Max-Planck-Institut fuer Stromungsforschung, Gottingen (West Germany).
ON THE DIFFUSION OF BINARY GAS MIXTURES IN CAPILLARIES AND POROUS MATERIALS [UEBER DIE DIFFUSION BINAERER GASGEMISCHE IN KAPILLAREN UND POROESEN STOFFEN]
K. Eger 1971 121 p refs In GERMAN
(Rept-51) Avail: NTIS

The diffusion behavior of a series of binary gas mixtures in a capillary and two fritted glasses in a wide pressure range was measured experimentally and compared with theory. For gas pairs with large mass differences the capillary behavior, as well as that of porous materials, which are treated as capillary bundles, show good agreement between experimental results and theory for the diffusion behavior in the transition region between large and small Knudson numbers. For gases with small mass differences, the influence of molecular pressure on the diffusion behavior was determined. At small Knudsen numbers, a condition of reversal of the diffusion shift occurs. This effect can be estimated theoretically and also determined experimentally for porous materials. Transl. by P.N.F.

N72-20316# Max-Planck-Institut fuer Stromungsforschung, Gottingen (West Germany).
THEORETICAL INVESTIGATION OF THE AMPLITUDE MODULATION OF SUPERSONIC WAVES DURING PASSAGE THROUGH TURBULENT WATER FLOW [THEORETISCHE UNTERSUCHUNG UEBER DIE AMPLITUDENMODULATION VON ULTRASCHALLWELLEN BEIM DURCHGANG DURCH TURBULENTE WASSERSTROEMUNGEN]
G. Wittek 1971 65 p refs In GERMAN
(Rept-52) Avail: NTIS

The passage of sound through a turbulent stream and the expansion reaction with turbulence dispersion are described. The amplitude modulation of an ultrasonic wave passing through a turbulent water stream is discussed. It is shown that the beam axis of the sound is perpendicular to the beam axis of the free stream. Frequency spectrum analysis is used to determine the structure of the current in the free stream. It is shown that the expansion and the intervals existing in the stream directions can be determined. Transl. by P.N.F.

N72-20317# Max-Planck-Institut fuer Stromungsforschung, Gottingen (West Germany).
INTERACTION BETWEEN TURBULENT BOUNDARY LAYERS AND COMPLIANT WALLS
R. Grosskreutz 1971 91 p refs In GERMAN; ENGLISH summary
(Rept-53) Avail: NTIS

Theoretical considerations and experiments are reported on the influence of compliant walls on turbulent boundary layer flow. The theoretical considerations suggested a new method of boundary layer control by means of compliant walls of a particular construction. Such walls were constructed in the form of flat plates and tested in a water tunnel. A difference was observed between the mean velocity profiles of the flow past rigid and compliant plates. The corresponding difference of momentum thickness was interpreted as drag alteration caused by the compliant plates. The maximum drag reduction was about 5 percent. The motion of a surface element of one compliant wall was observed by means of a schlieren apparatus. From the third-octave-spectra the frequency and wavenumber dependence of the flexibility of the compliant wall was calculated. Author

N72-20318# Technische Univ., Berlin (West Germany). Fakultaet fuer Maschinenwesen.
CALCULATION OF MASS AND ENERGY TRANSPORT OF TURBULENT PIPE FLOW CONSIDERING A NONISOTHERMAL HETEROGENEOUS REACTION OF ARBITRARY ORDER Ph.D. Thesis [BERECHUNG DES STOFF- UND ENERGIETRANSPORTS DER TURBULENTEN ROHRSTROEMUNG UNTER BERUECKSICHTIGUNG EINER NICHTISOTHERMEN HETEROGENEN REAKTION BELIEBIGER ORDNUNG]
Volker Asbeck 1971 118 p refs In GERMAN
Avail: NTIS

The mutual influence between a catalytic reaction and the mass transport and energy transport for turbulent flow conditions in a tubular reactor were investigated. On the smooth inner wall of the tubes is found the heterogeneous chemical reaction between the gas forming components. The reaction rate is an exponential function by which the temperature dependence of the velocity factors is described using the Arrhenius theory. The calculation of the turbulent velocity distribution is accomplished with the Prandtl mixing theory for a hydraulically formed stream.
Transl. by P.N.F.

N72-20319# Technische Univ., Berlin (West Germany).
IMPULSE AND MASS EXCHANGE IN FLOW AROUND SPHERES UNDER CONSIDERATION OF INNER CIRCULATION AND FREE CONVECTION Ph.D. Thesis [IMPULS- UND STOFFAUSTAUSCHAN UMSTROEMTEN KUGELN UNTER BERUECKSICHTIGUNG DER INNEREN ZIRKULATION UND DER FREIEN KONVEKTION]
Henner Schmidt-Traub 1970 124 p refs In GERMAN
Avail: NTIS

The influence of free convection on the impulse and mass exchange of flow circulating around spherical bodies is discussed. Consideration was given to the inner circulation of fluid spheres and the surface effects of free and forced convection in the continuous phase. The differential equations for the impulse and mass exchange were solved using the difference equations method. The relationships of Reynolds numbers, Sherwood numbers, and Schmidt numbers and the resistance of the spherical bodies to circulating flow are explained.
Transl. by P.N.F.

N72-20320# Council for Scientific and Industrial Research, Pretoria (South Africa).
USE OF THE METHOD OF STABILIZATION IN THE ANALYSIS OF UNCALCULATED FLOW CONDITIONS IN AXISYMMETRICAL NOZZLES
M. Ia. Ivanov Oct. 1970 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, 1969 p 137-139
(Rept-876) Avail: NTIS

The calculation of conditions with subsonic outflow velocities by means of numerical integration of gas dynamics equations using the stabilization method are presented. The calculations were made with the aid of difference diagrams for the numerical solution of the direct problem of mixed flow in nozzles under calculated conditions. The various flow conditions examined were: (1) calculated conditions, (2) uncalculated conditions with local supersonic zones, and (3) uncalculated conditions with local supersonic zone ending in a shock. The effects of viscosity and heat conductivity were not considered. Author

N72-20321# Council for Scientific and Industrial Research, Pretoria (South Africa).
APPLICATION OF SPALDING'S METHOD TO PLANAR AND AXISYMMETRICAL FLOW IN COMBUSTIBLE MIXTURES
H. Dumitrescu Nov. 1970 15 p refs Transl. into ENGLISH from Rev. Romaine Sci. Tech., Ser. Mecan. Appl. (Bucharest), v. 14, no. 5, 1969 p 1123-1136
(Rept-888) Avail: NTIS

An analytical method is proposed for the calculation of the velocity and pressure distribution, the shape of flame front, and the width of confined flames developing in a constant cross-section channel. The method is based on the theory of Spalding which was generalized to comprize axisymmetrical flow. In terms of this theory, there is a distinct similarity between a flame and a turbulent jet originating from a central stabilizer. The velocity of cool air entrainment has a decisive influence on the rate of combustion (the 'entrainment effect'). The theoretical results are in good agreement with the experimental results obtained by others. Author

N72-20322*# United Aircraft Corp., East Hartford, Conn.
ADDITIONAL RESEARCH ON INSTABILITIES IN ATMOSPHERIC FLOW SYSTEMS ASSOCIATED WITH CLEAR AIR TURBULENCE
Richard C. Stoeffler Washington NASA Apr. 1972 75 p refs (Contract NASw-1582)
(NASA-CR-1985) Avail: NTIS CSCL 20D

Analytical and experimental fluid mechanics studies were conducted to investigate instabilities in atmospheric flow systems associated with clear air turbulence. The experimental portion of the program was conducted using an open water channel which allows investigation of flows having wide ranges of shear and density stratification. The program was primarily directed toward studies of the stability of straight, stratified shear flows with particular emphasis on the effects of velocity profile on stability; on studies of three-dimensional effects on the breakdown region in shear layers; on the the interaction of shear flows with long-wave length internal waves; and on the stability of shear flows consisting of adjacent stable layers. The results of these studies were used to evaluate methods used in analyses of CAT encounters in the atmosphere involving wave-induced shear layer instabilities of the Kelvin-Helmholta type. A computer program was developed for predicting shear-layer instability and CAT induced by mountain waves. This technique predicts specific altitudes and locations where CAT would be expected. Author

N72-20323# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
AN IMPLICIT FINITE-DIFFERENCE SCHEME FOR THE CALCULATION OF HYPERSONIC SLIPFLOW BOUNDARY LAYERS
E. H. Hirschel 1971 86 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-97) Avail: NTIS; DFVLR Porz-Wahn: 23 DM

An implicit finite difference scheme is presented for the numerical integration of the governing equations of hypersonic slip flow boundary layers. Derivations are given for the matrix elements of the solution and for the recursion relations of the algorithm. The calculation of slip flow boundary conditions, which are given as differential equations, is described along with the technique of decoupling the momentum equations and the energy equation from the continuity equation. A detailed description of the FORTRAN 4-machine program, the listing, the flow chart, and a sample calculation for the purpose of program testing conclude the paper. Author

N72-20324# Technische Hochschule, Darmstadt (West Germany). Fakultaet fuer Mathematik und Physik.
FORMATION OF COMPRESSIVE SHOCKS IN REAL GASES Ph.D. Thesis [ENTSTEHUNG VON VERDICHTUNGSSTOESSEN IN REALEN GASEN]
Heiko Schmitt 16 Jul. 1971 199 p refs In GERMAN
Avail: NTIS

Streams of gases which do not behave like ideal gases were investigated to determine if they flowed or ionized during the course of the gas thermodynamic relaxation process. It was assumed that the gas could be treated as a single component continuum. The mechanical and thermodynamic balance equations for various gases are presented. The principle equations defining the thermodynamic properties are formulated. The influence of magnetic fields on ionized gases is described. Entropy and

relaxation parameters are expressed mathematically. The effects of density and velocity in the properties of the gas are examined.
Transl. by P.N.F.

N72-20325# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
NONEQUILIBRIUM STAGNATION POINT BOUNDARY LAYER OF A PARTIALLY IONIZED GAS
K. Matsuoka (Nara Techn. Coll.) and M. Nishida 30 May 1971 25 p refs
(CP-30) Avail: NTIS

The electron temperature profile across the stagnation point boundary layer and the inviscid layer is described for the case where electrons are in thermal nonequilibrium with atoms and ions in a free stream. The wall boundary conditions for the electron temperature and the concentration of electron-ion pair were determined from the conditions for the continuity of electron energy flux and ion mass flux through the outer edge of an ion sheath, and the zero net current at the wall. Considering the boundary layer and the shock at the same time, the profile of electron temperature was obtained from the free stream to the wall.
Author

N72-20326# Sandia Labs., Albuquerque, N.Mex.
EXPERIMENTAL STUDY OF THE RESPONSE OF WATER DROPLETS TO FLOWS BEHIND PLANE SHOCK WAVES
Daniel P. Aeschliman Oct. 1971 38 p refs Sponsored by AEC
(SC-RR-710540) Avail: NTIS

Time-dependent droplet deformation and displacement data were obtained in a shock tube by means of a multiple-exposure photographic technique. These data generally confirm data reported elsewhere at comparable values of shock Mach number and post-shock dynamic pressure in the range of 10,000 to 60,000 torr. In this range, the effective drag coefficient = 2.31 + or - .10. At high incident shock Mach number and low-dynamic pressure, a much larger effective drag coefficient, = 7.17 + or - 0.54, is obtained. The reasons for this difference are not known, and suggest a need for further research in this area. Two-nanosecond, high-resolution single-frame photographs of the droplets at various times after shock wave impact indicate that the mist stripped from the droplet periphery is approximately 1 micron in diameter.
Author

N72-20327# Los Alamos Scientific Lab., N.Mex.
INCOMPRESSIBLE LAMINAR VAPOR FLOW IN CYLINDRICAL HEAT PIPES
C. A. Bankston and Hadley J. Smith 1970 69 p refs Presented at the Ann. Meeting of Am. Soc. of Mech. Engr., Washington, D. C., 28 Nov. 1971
(LA-DC-12575; Conf-711112-2) Avail: NTIS

Solutions of the complete two-dimensional Navier-Stokes equations for the steady flow in circular heat pipes with various distributions of evaporation and condensation were obtained by finite difference methods. A series solution for the slow motion case was obtained which is valid for arbitrary distributions of evaporation and condensation. The conditions in the evaporator section of the heat pipe are described by similar solutions in both limits, and the characteristic of the flow in the transition from low to high Reynolds number is completely determined by the evaporator Reynolds number. The flow in the condenser depends upon the condenser Reynolds number, the evaporator Reynolds number, and the condenser length-to-diameter ratio. Complete flow descriptions for symmetrical and asymmetrical heat pipes are presented and practical results for the calculation of pressure losses in low speed, heat pipe vapor flows are given.
Author

N72-20328# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
DEVELOPING TWO-PHASE FLOW IN TUBES AND ANNULI. PART 1: EXPERIMENTAL RESULTS, CIRCULAR TUBE. PART 2: ANALYTICAL STUDIES, TUBES, AND ANNULI
E. Janssen, J. A. Kervinen, and H. T. Kim Feb. 1971 126 p refs
(Contract AT(03-4)-189)
(GEAP-10341-Pt-1; CEAP-10341-Pt-2) Avail: NTIS

Experimental and theoretical studies of developing two-phase flow in tubes and annuli were conducted. Tests were run in a 0.68 in. ID tube test section, with steam-water at 1000 psia flowing vertically upward. Measurements were made of the flow in the annular region next to the wall (the film region), by an isokinetic sampling technique, using concentric splitters which split off the sample flow from the rest of the flow. Film thickness was measured using a conductivity probe. Pressure drop was measured under both adiabatic and boiling conditions. The results are presented. A theoretical model was derived for describing the flow rate in the liquid film for fully developed two-phase annular flow in a circular tube. Comparison of computed results with measured data showed a satisfactory agreement (75% of the data lay within 15% of prediction). An expression for the net interchange rate of liquid droplets between core and liquid film regions, for developing adiabatic two-phase annular flow in vertical annuli was derived.
NSA

N72-20329# Aktiebolaget Atomenergi, Studsvik (Sweden).
STUDIES OF TURBULENT FLOW PARALLEL TO A ROD BUNDLE OF TRIANGULAR ARRAY
B. Kjellstroem Mar. 1971 164 p refs
(STU-68-263/U-210) Avail: AEC Depository Libraries

Results are presented from an experimental and theoretical study of turbulent flow in a rod bundle of triangular array with pitch to diameter ration of 1.217. The experiments included measurements of pressure drop and local distributions of axial and secondary flow velocities, turbulence intensities, Reynolds stresses and the wall shear stress. The results of the turbulence measurements were used for calculation of local eddy diffusivities. It is shown that the diffusivity is strongly nonisotropic. The theoretical studies included calculations of the distributions of the axial velocity and the kinetic energy of turbulence in the flow, using the computer program developed by Spalding (1968). A modified version of Prandtls energy-length model (1945) in combination with Buleevs method (1963) for estimation of the turbulent length scale was employed. The calculated results are compared to the measured data and it is concluded that the agreement is satisfactory.
Author (NSA)

N72-20330# Max-Planck-Institut fuer Stromungsforschung, Gottingen (West Germany).
LAMINAR TURBULENT FLOW [WIRBELSTROEMUNGEN IN LAMELLEN]
Hermann Bauer Oct. 1971 29 p refs In GERMAN
(Rept-9/1971) Avail: NTIS

The velocity distribution in vortices produced by liquid injection in a solution lamella is measured, and the shape of the deformed lamella is determined. The lamella is formed in a wire ring from a mixture of water and soap suds. Two cameras are used to record the flow patterns. The vortex is produced by injection of a mixed liquid with a hypodermic needle. The lamella liquid is easily excited to relatively fast vortex motion, without damage of the lamella. The main results are that the vortex flow is similar to potential flow, and the arising shapes of the lamella have not been observed before.
ESRO

N72-20331# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aerodynamik.
CALCULATION OF THE POTENTIAL FLOW AROUND AXISYMMETRIC BODIES, COWLS, AND INLETS [BERECHNUNG DER POTENTIALSTROEMUNG UM ROTATIONSSYMMETRISCHE RUEMPFE, RINGPROFILE UND TRIEBWERKSEINLAEUFE]
W. Geissler Cologne DGLR Aug. 1971 22 p refs In GERMAN; ENGLISH summary Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971

(AVA-FB-7131) Avail: NTIS

The potential flow around bodies of revolution (closed body inlets, cowls) is calculated using surface distributions of sources, sinks, and vortices. This method deals with an arbitrary flow about the body. Besides axisymmetric flows and flows at incidence to the body axis, it is possible to take care of flow field induced by another body (interference problem). A panel method is used for the numerical solution of the problem. In an axisymmetric body the surface elements are frustrums of cones of small axial length. Author (ESRO)

N72-20332# Technische Hogeschool, Delft (Netherlands).
NOTES ON THE UNSTEADY RECTILINEAR MOTION OF A PERFECT GAS. PART 2: SOME FORMAL ASPECTS OF THE LAGRANGIAN EQUATIONS OF MOTION FOR THE UNSTEADY RECTILINEAR MOTION OF A PERFECT GAS
J. A. Steketee Jun. 1971 34 p refs
(VTH-168) Avail: NTIS

Forms of the equations of motion for the rectilinear, unsteady motion of a perfect gas, are systematically developed starting from the equations in the Lagrangian form, which are then transformed to relations between Jacobians. It is shown that a relation between the equation of mass conservation and momentum conservation can be established by a method analogous to the Lagrangian-Hamiltonian approach. Finally the characteristics of the different equations are studied. ESRO

N72-20333# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
APPLICATION OF THE VORTEX DISTRIBUTION TECHNIQUE TO THREE-DIMENSIONAL BODIES MOVING THROUGH AN INCOMPRESSIBLE FLUID Independent Research Report, Feb. - Jul. 1971
Robert A. Lott Aug. 1971 30 p refs
(AD-732953; LMSC/HREC-D225334) Avail: NTIS CSCL 20/4

The report presents results of a study to develop a method for evaluating the forces on three-dimensional shapes in steady subsonic flow. The technique is developed by formulating a mathematical model which approximates the various aspects of the physical features of the flow. The mathematical model is constructed around the use of vortex elements which simulate the effects of the body and satisfy the governing equation. Author (GRA)

N72-20334# Notre Dame Univ., Ind. Coll. of Engineering.
DRAG REDUCTION DEGRADATION OF DILUTE POLYMER SOLUTION IN TURBULENT TUBE FLOW
Nicholas D. Sylvester and Stamley M. Kumor Nov. 1971 67 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-734676; THEMIS-UND-71-6) Avail: NTIS CSCL 20/4

Drag reduction degradation characteristics of Separan AP30 are reported. A recycle tube flow experiment was used to investigate this property of drag reducing polymer solutions. Experimental pressure gradient and flow rate measurements were made as a function of time. From this data, friction factor-time plots on log-log coordinates were constructed, all of which exhibited three distinct regions which are discussed. Correlations are presented relating the process time in which maximum drag reduction exists, and the process time in which significant drag reduction exists, to the polymeric and system flow variables. GRA

N72-20849*# Northrop Corp., Hawthorne, Calif.
DETERMINATION OF SPACE SHUTTLE FLOW FIELD BY THE THREE-DIMENSIONAL METHOD OF CHARACTERISTICS
Chong-Wei Chu and S. A. Powers *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 47-64 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

N72-20850*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF SHOCK CAPTURING AND CHARACTERISTICS METHODS TO SHUTTLE FLOW FIELDS
P. Kutler, J. V. Rakich, and G. G. Mateer *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 65-92 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

N72-20851*# Lockheed Missiles and Space Co., Palo Alto, Calif.
FLOW FIELD PREDICTIONS FOR A SLAB DELTA WING AT INCIDENCE
R. J. Conti, P. D. Thomas, and Y. S. Chou *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 93-114 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

N72-20852*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE ORBITER REENTRY FLOW FIELD AND HEATING ANALYSIS
W. C. Rochelle (TRACOR, Inc., Austin, Tex.), B. B. Roberts, F. W. Vogenitz (TRW Systems), and L. Dattorre (TRW Systems) *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 115-156 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

N72-20853*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A VISCOUS STARTER SOLUTION FOR SHUTTLE FLOW FIELD COMPUTATIONS
C. P. Li (Lockheed Elec. Co., Inc.) and W. D. Goodrich *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 157-184 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

N72-20854*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHEMICAL NONEQUILIBRIUM EFFECTS ON THE FLOW IN THE WINDWARD PLANE OF SYMMETRY OF A BLUNTED DELTA ORBITER
J. A. Lordi (Cornell Aeron. Lab., Inc.), R. J. Vidal (Cornell Aeron. Lab., Inc.), and C. B. Johnson *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 185-238 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

N72-20855*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVISCID SURFACE STREAMLINE PROGRAM FOR USE IN PREDICTING SHUTTLE HEATING RATES
In its Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 239-254 refs (See N72-20847 11-31)
(Contract NAS1-10277)
Avail: NTIS CSCL 20D

N72-20866*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE SHUTTLE BOOSTER MULTI-ENGINE BASE FLOW ANALYSIS
Homer H. Tang, Charles R. Gardiner, William A. Anderson, and Jhon Navickas *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 519-605 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20D

N72-20870*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF BOUNDARY LAYER TRANSITION

CRITERIA FOR SPACE SHUTTLE ORBITER ENTRY
Vernon T. Helms, III *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 683-704 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20D

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-20335 National Lending Library for Science and Technology, Boston Spa (England).
THE LAPLACE TIDAL EQUATION IN THE COMPLEX DOMAIN
Ju. V. Semenovskij [1971] 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 7, 1971 p 459-460
(NLL-M-22073-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The complex domain of the wave frequency as a function of twice the natural frequency of the earth's rotation was studied. Numerical solutions for the symmetrical case were obtained. For each complex frequency, a corresponding eigenvalue and latitudinal eigenfunction were found. The results are given in the form of a mapping of the complex frequency plane onto the eigenvalue plane. N.E.N.

N72-20336 National Lending Library for Science and Technology, Boston Spa (England).
ATLANTIC WATERS AS A FORECASTING FACTOR
E. I. Caplygin and A. O. Spajher [1970] 16 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauch. Issled. Inst. (Leningrad), v. 293, 1970 p 5-6
(NLL-M-22083-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The fundamental principles concerning the physical soundness of using heat and salt advection, by Atlantic Ocean currents, to forecast hydrometeorological changes are discussed. The time and speed of Atlantic water propagation from the northern part of the Greenland Sea to each of the Arctic seas were measured. From these measurements it was determined that the rate at which Atlantic water enters the Arctic Ocean and Arctic Basin is related to the frequency of the meridional type of atmospheric circulation in winter. It was also determined that the Atlantic waters give up heat year round, but more so in winter. It was concluded that long range forecasting of oceanological phenomena in the Arctic seas may be done in such a manner with a very high rate of accuracy. E.H.W.

N72-20337 Kodaikanal Observatory (India).
[OBSERVATIONS OF PROMINENCES AND CALCIUM FLOCCULI AND MAGNETIC AND IONOSPHERIC DATA OBSERVATIONS]
9 Sep. 1970 343 p
(DGO-11-177-385; Bull-177) Copyright. Avail: Issuing Activity: Inland Rs. 79.50 or Foreign £9 5s 6d or $28.62

Solar, geomagnetic, and ionospheric data for the last half of 1965 are presented. The solar data include observations of prominences, calcium flocculi, flares, and radio emission. Hourly data on the geomagnetic field and ionospheric characteristics are tabulated. N.E.N.

N72-20338*# Texas A&M Univ., College Station. Dept. of Physics.
DISCRETE ORDINATE THEORY OF RADIATIVE TRANSFER. 2: SCATTERING FROM MARITIME HAZE
George W. Kattawar, Gilbert N. Plass, and Frances E. Catchings 3 Dec. 1971 44 p refs Submitted for publication
(Grant NGR-44-001-117)
(NASA-CR-125817) Avail: NTIS CSCL 04A

Discrete ordinate theory was used to calculate the reflected and transmitted radiance of photons which have interacted with plane parallel maritime haze layers. The results are presented for three solar zenith angles, three values of the surface albedo, and a range of optical thicknesses from very thin to very thick. The diffuse flux at the lower boundary and the cloud albedo were tabulated. The forward peak and other features in the single scattered phase function caused the radiance in many cases to be very different from that for Rayleigh scattering. The variation of the radiance with both the zenith or nadir angle and the azimuthal angle is more marked, and the relative limb darkening under very thick layers is greater, for haze than for Rayleigh scattering. The downward diffuse flux at the lower boundary for A = 0 is always greater and the cloud albedo is always less for haze than for Rayleigh layers. Author

N72-20339*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
INTERHEMISPHERIC COMPARISON OF ATMOSPHERIC CIRCULATION FEATURES AS EVALUATED FROM NIMBUS SATELLITE DATA Annual Report, 1 Apr. 1970 - 30 Jun. 1971
E. R. Reiter, T. H. VonderHaar, J. E. Lovill, R. Adler, S. Srivatsangam, and R. Abbey 30 Jun. 1971 62 p refs
(Grant NGR-06-002-098)
(NASA-CR-125812) Avail: NTIS CSCL 04A

Findings are presented for IRIS data from NIMBUS 3 in mapping the global ozone distribution. The seasonal and regional variations of ozone, especially in the Southern Hemisphere, reveal features that were not evident from the sparse ground-based ozone observation network in this hemisphere. A regression analysis was undertaken for temperature and height fields on radiance data. Spectrum analyses of upper wind data from the North American section and Australia were completed. Author

N72-20340*# TRW Systems Group, Redondo Beach, Calif.
ADVANCED STUDY OF GLOBAL OCEANOGRAPHIC REQUIREMENTS FOR EOS A/B: TECHNICAL VOLUME Final Report
Jan. 1972 293 p refs
(Contract NASw-2163)
(NASA-CR-125816; TRW-17683-6001-R0-00) Avail: NTIS CSCL 08C

Characteristics of the ocean are considered in terms of U.S. social, scientific and ecomomic priorities and in terms of the measurements that can best be made from a spacecraft. The kinds of information needed to advance the basic ocean sciences, to improve marine transportation and fisheries operations, and to provide information for pollution control are discussed. These information needs were related to sensor concepts and an optimum sensor complement is presented, together with orbital considerations. The data-gathering capabilities of an oceanographic spacecraft were considered in relation to those of terrestrial oceanographic programs, using airborne, surface, and submarine platforms. Data management problems are discussed and are considered to be solvable with current technology. Author

N72-20341*# TRW Systems Group, Redondo Beach, Calif.
ADVANCED STUDY OF GLOBAL OCEANOGRAPHIC REQUIREMENTS FOR EOS A/B: APPENDIX VOLUME Final Report
Jan. 1972 125 p refs
(Contract NASw-2163)
(NASA-CR-125815; TRW-17683-6001-R0-00-App) Avail: NTIS CSCL 08C

Tables and graphs are presented for a review of oceanographic studies using satellite-borne instruments. The topics considered include sensor requirements, error analysis for

wind determination from glitter pattern measurements, coverage frequency plots, ground station rise and set times, a technique for reduction and analysis of ocean spectral data, rationale for the selection of a 2 PM descending orbit, and a priority analysis. K.P.D.

N72-20342*# Allied Research Associates, Inc., Concord, Mass.
NIMBUS EARTH RESOURCES OBSERVATIONS
Romeo R. Sabatini, George A. Rabchevsky, and John E. Sissala Nov. 1971 271 p refs
(Contract NAS5-21617)
(NASA-CR-122348; TR-2; Rept-9G90-8) Avail: NTIS CSCL 08G

The potential for utilizing data gathered by Nimbus satellites to study the earth surface and its physical properties is illustrated. The Nimbus data applicable to investigations of the earth and its resources, and to the problems of resolution and cloud cover are described. Geological, hydrological, and oceanographic applications are discussed. Applications of the data to other fields, such as cartography, agriculture, forestry, and urban analysis are presented. Relevant information is also given on the Nimbus orbit and experiments; surface and atmospheric effects on HRIR and THIR radiation measurements; and noise problems in the AVCS, IDCS, HRIR, and THIR data. Author

N72-20343*# California Univ., Los Angeles. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report
Robert N. Colwell 1 Jan. 1972 446 p refs Original contains color illustrations
(Grant NGL-05-003-404)
(NASA-CR-125828) Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

Plans are presented for an integrated study of the entire California resource complex through remote sensing from aircraft and spacecraft and the socio-economic factors affecting present and future resource management. For individual titles, see N72-20344 through N72-20352.

N72-20344*# California Univ., Los Angeles.
INTRODUCTION
In its An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 11 p (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

The background behind the inception of this proposal is briefly described. The reasons for selecting California for the test site were: (1) wide variety of earth resources, landforms, and climatic factors; (2) large amounts of remote sensing data and associated ground truth data already available; (3) social and environmental stresses already being felt make California a model of things to come, both nationally and globally; (4) many competent investigators known to be residing in the state; and (5) appropriate NASA-funded facilities already in California available to provide administrative and monitoring support. The nature and delicacy of conducting such a study are reviewed, along with the types of data integration to be achieved. A.L.

N72-20345*# California Univ., Los Angeles. Social Sciences Group.
DEFINITION OF EARTH RESOURCE POLICY AND MANAGEMENT PROBLEMS IN CALIFORNIA
C. West Churchman, William Gotcher, Ida Hoos, Ralph Lewis, and Richard O. Mason *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 106 p refs (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

The socioeconomic aspects of the Earth Resources Program are investigated in detail and the need to understand the beneficiaries of the ERTS technology, their relationship to the information, and the decisions which could be influenced by this information are emphasized. Three main lines of endeavor are discussed: (1) clearer definition of questions needing clarification and definition before meaningful answers can be sought; (2) development of a taxonomy of beneficiaries of data; and (3) preliminary modeling of the Feather River Project. A.L.

N72-20346*# California Univ., Davis. Dept. of Water Science and Engineering.
USER REQUIREMENTS FOR THE APPLICATION OF REMOTE SENSING IN THE PLANNING AND MANAGEMENT OF WATER RESOURCE SYSTEMS
Robert H. Burgy, David R. Storm, and Maurice L. Horton *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 22 p refs (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08H

Research results analyze hydrologic and water resource systems; establish the major parameters needed to meet the informational requirements of water resource managers; specify when and where data are needed; and suggest the relative merits of classic techniques vs. remote sensing techniques for acquisition of the necessary data. The fundamental framework within which the analysis was made is a model of the hydrological and water resources systems and their discrete subsystems. The subsystems identified within the model are: (1) evaporation (evapotranspiration); (2) vegetation (includes soil-vegetation interrelation); (3) rain and snow; (4) streams and estuaries; (5) reservoirs and lakes; (6) unsaturated soil zone; and (7) saturated zone. A.L.

N72-20347*# California Univ., Berkeley. Forestry Remote Sensing Lab.
REMOTE SENSING DATA AS AN AID TO RESOURCE MANAGEMENT IN NORTHERN CALIFORNIA
Gene A. Thorley, David Carneggie, William Draerer, Donald Lauer, Jerry Lent, and Edwin Roberts *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 144 p refs Original contains color illustrations (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

An evaluation is being made of the usefulness of remote sensing data in providing general land use planning information pertaining to the coastal zone of northern California. The test area covers the entire coast of California extending from the San Francisco Bay Area to the Oregon border. Attempts will be made to enumerate those physical parameters of the landscape which are of particular importance in determining the potential of an area in terms of land use, be it natural resource utilization, urban development, or industrial development. A quantitative evaluation will be made of the degree to which these parameters can be mapped or otherwise extracted from remote sensing data by means of both human interpretation and automatic feature classification. A.L.

N72-20348*# California Univ., Los Angeles.
RIVER MEANDER STUDIES
Richard Lingenfelter and Gerald Schubert *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 19 p (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08H

Research is underway to develop a relatively simple and inexpensive technique to assess the water resources of large, relatively undeveloped geographical areas in order that comprehensive water development plans may be prepared with less expenditure of money and time for the collection of data on the earth surface. Investigations are being made to determine if it will be possible to extract data on the total discharge of a river, both past and present, from satellite television photography of river meander patterns. Geomorphological investigations of possible correlations between the stream meander power spectrum and the stream discharge frequency distribution have been made

for the Feather River in northern California. Procedures for generating the stream discharge probability density functions and meander power spectra for other rivers are described. A.L.

N72-20349*# California Univ., Santa Barbara. Dept. of Geography.
ASSESSMENT OF THE IMPACT OF THE CALIFORNIA WATER PROJECT ON THE WEST SIDE OF THE SAN JOAQUIN VALLEY
John E. Estes, Leslie W. Senger, Lyndon Wester, James Viellenave, Patrick Fortune, Bruce Davis, and Thomas Soper *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 35 p Original contains color illustrations (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08H

Investigations are being conducted of various regional scale parameters that can be used to characterize the nature of the area transformation that is taking place in the San Joaquin Valley. Information is being extracted from remote sensing imagery for: land use, general and urban-oriented; vegetation, general and problem oriented (boron and salinity affected areas); irrigation systems; and identification of crops. A.L.

N72-20350*# California Univ., Riverside. Dept. of Geography.
ASSESSMENT OF THE IMPACT OF THE CALIFORNIA WATER PROJECT IN SOUTHERN CALIFORNIA
Leonard W. Bowden, William G. Brooner, V. B. Coleman, D. Goehring, R. A. Minnich, D. A. Nichols, and J. Viellenave *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 58 p refs Original contains color illustrations (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08H

Investigations are in progress which deal with the applications of remote sensing data in the study of earth resources in southern California. Areas of interest are: (1) inventory of rural land use and monitoring land use change related to Lake Perris; (2) development of models and methodologies for utilizing remotely sensed data; (3) utilization of synoptic photography to develop techniques for urban and regional planning; (4) update of previous NASA study to map vegetation in southern California from color infrared photography; (5) development of methodologies and production of gross land use maps, using computer graphics; and (6) use of remote sensing as a technique for assessing environmental quality as affected by the impact of urbanization in southern California. A.L.

N72-20351*# California Univ., Davis. Dept. of Electrical Engineering and Computer Sciences.
DIGITAL HANDLING AND PROCESSING OF REMOTE SENSING DATA
R. Algazi and D. Akrison *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 1 Jan. 1972 25 p (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

Progress is reported on work done on the digital handling and processing of remote sensing data, and more specifically as it refers to electronic image enhancement. Discussed in detail are: (1) detailed specification of plans for the digital processing facility which is the heart of present and current research; (2) assembly and construction of the digital image processing facility; (3) work on means and programs for data acquisition and handling, and developing a system for use in programming various digital image processing tasks; and (4) development digital signal processing algorithms of broad relevance to feature enhancement of remote sensing data. A.L.

N72-20352*# California Univ., Davis. Dept. of Agricultural Engineering.
INVESTIGATION OF ATMOSPHERIC EFFECTS IN IMAGE TRANSFER **c14**
K. L. Coulson and R. L. Walraven *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Devices 1 Jan. 1972 16 p Original contains color illustrations (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

A dual channel polarizing radiometer has been built for measuring the intensity and polarization parameters of incident light rapidly with high precision. The instrument uses the photon counting technique to measure intensity. A computer program has been written for computing the effects of dust, haze, and other aerosol particles on the field of radiation emerging from the top of the atmosphere. By the use of atmospheric models, it will be possible to study the sensitivity of the radiation field to parameters such as the size-frequency distribution of aerosol particles, real and complex parts of the index of refraction, and the vertical profile of the aerosol concentrations. Photographs have been taken with polarizing optics to obtain a preliminary estimate of the advantage to be gained by the use of polarization for enhancing the transfer of images from surface to high altitude sensor in the actual atmosphere. A.L.

N72-20353*# Geological Survey, Washington, D.C. Geographical Applications Program.
PROPOSED EXPERIMENTAL PROGRAMS FOR TESTING REMOTE SENSOR APPLICATIONS IN THE METROPOLITAN WASHINGTON AREA Final Report
Harry J. Mallon and Joan Y. Howard Feb. 1972 21 p refs
(NASA Order W-13318; Contract DI-14-08-0001-12708)
(NASA-CR-125825; TR-7; USGS-IR-NASA-221) Avail: NTIS CSCL 08G

A group of suggested experiments is described, which are to be conducted with ERTS-A and high altitude aircraft imagery during the 1972 period. Methods of analysis and observation of land use, urban change, transportation, and possible pollution, using small scale, low resolution data, are discussed. Author

N72-20354# RAND Corp., Santa Monica, Calif.
MECHANISM FOR BLOW-OFF OF THE EARTH'S ATMOSPHERE: POPULATION OF THE VAN ALLEN BELT
L. Marshall Libby Apr. 1971 23 p refs
(P-4631) Avail: NTIS

Rate of loss of terrestrial atmosphere from earthquake motions is estimated. Some of this atmosphere ionizes as it is blown off through the magnetosphere, and the amount so ionized seems to be ample to account for C, N, and O found in the Van Allen belt. Author

N72-20355*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
METHOD AND APPARATUS FOR OBTAINING OXYGEN FROM LUNAR OR SIMILAR SOIL Patent Application
William R. Downs, inventor (to NASA) Filed 28 Feb. 1972 19 p
(NASA-Case-MSC-12408-1; US-Patent-Appl-SN-229916) Avail: NTIS CSCL 03B

A method and apparatus are described for recovering oxygen from soil containing metal oxides such as alumina, silica, calcia, magnesia, and ilmenite. The material containing the oxides is placed in a vessel and reacts with fluorine to provide oxygen and metal fluorides. The oxygen from this reaction is recovered and stored, after purifying, and the metal fluorides further react with potassium vapor to provide potassium fluoride and free metals. The potassium fluoride is then subjected to electrolysis, whereby the potassium and fluorine are separated and recycled for further use in the system. Valuable free metals are recovered for other uses. NASA

N72-20356*# Techtran Corp., Glen Burnie, Md.
MEASUREMENT OF SOIL MOISTURE FOR PURPOSES OF TERRAIN EXPLORATION
H. Vilkner Washington NASA Mar. 1972 11 p refs Transl. into ENGLISH from Angew. Meteorol., (West Berlin) v. 5, no. 3/4 p 113-116
(Contract NASw-2037)

(NASA-TT-F-14220) Avail: NTIS CSCL 08M

In view of the factors affecting soil moisture (precipitation, ground cover, etc.), use of carbon electrodes inserted in the ground ensures optimum sensor-water contact and uniform measurement conditions. Parameters for sensors and meters are discussed, as well as convenient scales for expressing soil moisture. Author

N72-20357*# Techtran Corp., Glen Burnie, Md.
THE USE OF TENSIOMETERS IN STUDYING THE WATER CYCLE OF SOILS IN SWAMPY FORESTS
M. I. Vomperskaya and I. I. Sudnitsyn Washington NASA Apr. 1972 6 p Transl. into ENGLISH from Les. Khoz. (Moscow), v. 19, no. 8, Aug. 1966 p 28-29
(Contract NASw-2037)
(NASA-TT-F-14218) Avail: NTIS CSCL 08H

The results are presented of the determination of soil moisture content and moisture pressure and their relationship by two different methods. It is demonstrated that the tensiometric method is preferable to taking a soil sample by drilling as it is more accurate and yields results much more quickly. Author

N72-20358*# Techtran Corp., Glen Burnie, Md.
A NEW METHOD OF MEASUREMENT FOR DETERMINING SOIL MOISTURE WITH Co-60 AND Cs-137
W. Hesse Washington NASA Mar. 1972 10 p refs Transl. into ENGLISH from Angew. Meteorol., Beih. Z. Meteorol. (Berlin), V. 5, no. 3/4 p 107-112
(Contract NASw-2037)
(NASA-TT-F-14219) Avail: NTIS CSCL 08M

The use of a gammascopic method to determine soil moisture, based on the variable shielding effect of the ground with respect to gamma radiation, is described. It was determined that the gammascopic method requires less work than the drilling method, has an accuracy exceeded only by the neutron diffusion method, does not disturb the measurement area, and involves no radiation damage. The amount of radioactivity detected at the surface decreases with increasing soil moisture as well as thickness and density of the soil. The use of Cs-137 is recommended in layers down to 50 cm and Co-60 below 50 cm. The preparations should have a radioactivity of 10 to 30 mC. N.E.N.

N72-20359*# Translation Consultants, Ltd., Arlington, Va.
TEMPERATURE VARIABILITY OF THE UPPER SOIL LAYER IN A BARLEY FIELD
L. E. Int Washington NASA Apr. 1972 6 p Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 190, 1965 p 65-67
(Contract NASw-2038)
(NASA-TT-F-14149) Avail: NTIS CSCL 08M

Temperatures were measured in Estonia during 1963 and 1964 in barley fields of different soils at depths of 5 and 10 cm. The soil types were sandy loam, loam, and peat. Preliminary conclusions include the following: (1) Soil temperature variability is connected chiefly with the microrelief of the field and the soil distribution. This produces uneven growth of the crop in the field, which in turn has a reverse influence on microclimate. (2) Temperature change is within 0.5 to 1.0 C in an even field with different soils but identical moistening. N.E.N.

N72-20360*# Scientific Translation Service, Santa Barbara, Calif.
APPLICATION OF SPATIAL FILTERS IN MEASURING THE RATIO W/H UNDER CONDITIONS OF AN AERIAL-MAPPING PROCESS
A. V. Almazon Washington NASA Mar. 1972 20 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Geod. Aerofotosemka (Moscow), no. 1, 1969 p 94-105
(Contract NASw-2035)
(NASA-TT-F-14234) Avail: NTIS CSCL 08B

Spatial filters are applied to the ratio W/H determination by measuring signal frequencies at the sensor output during aerial surveys. These surveys are based on transformation of the spatial characteristics of an object into frequency characteristics. Procedures for determining the correlation function and transfer functions in the production of the energy spectrum of an aerial landscape are described. Author

N72-20361# Danish Meteorological Inst., Charlottenlund.
THULE GEOPHYSICAL OBSERVATORY, MAGNETIC RESULTS 1965
1971 59 p refs
(ISBN-87-7478-043-3) Avail: NTIS

Tables are presented for the following magnetic data: (1) hourly mean values; (2) daily means; (3) averages for all days, including the five international quiet and five disturbed days, given for each hour; and (4) daily values for maximum and minimum of H, D, and Z, daily range of H, D, and Z, K-indices; and recording room temperature. The magnetographs, determination of baseline values and reduction formulas, and the adopted reduction formulas are also considered briefly. K.P.D.

N72-20362# Osservatorio Geofisico Sperimentale, Trieste (Italy).
ITALIAN EARTHQUAKE CATALOGUE FROM THE BEGINNING OF THE CHRISTIAN AGE UP TO 1968
F. Giorgetti and E. Iaccarino (CNEN, Rome) 1971 98 p refs
(Contrib-201-App) Avail: NTIS

A listing of earthquakes in Italy is presented covering the period from the year 7 A.D. through 1968. K.P.D.

N72-20363# Institut d'Aeronomie Spatiale de Belgique, Brussels.
AERONOMIC CHEMISTRY OF THE STRATOSPHERE
M. Nicolet 1972 77 p refs
(Aeronomica-Acta-A-96) Avail: NTIS

In the stratosphere, dissociation of H2O, CH4, H2 is mainly brought about by reaction processes with excited oxygen atoms produced by the photodissociation of ozone. A discrepancy was noted between theoretical and observational concentrations of O3 in the upper stratosphere. Two explanations are possible: (1) Solar radiation fluxes for O2 photodissociation are too large along with too large rate coefficients. (2) Absorption cross sections or ozone reduction occur which were brought about by the effect of hydrogen compounds or nitrogen oxides. The fact that the ratio of the hydroxyl and hydroperoxyl radical concentrations cannot be determined with adequate precision complicates the calculation of the destruction of ozone which occurs through reactions of OH and HO2, not only with atomic oxygen in the upper stratosphere but also with CO and NO in the lower stratosphere, respectively. Author

N72-20364*# Translation Consultants, Ltd., Arlington, Va.
THE KOSMOS 243 INVESTIGATION OF MICROWAVE RADIATION OVER A CULTIVATED LANDSCAPE
G. M. Belyakova, A. S. Gurvich, D. T. Matveyev, and B. P. Mironov Washington NASA Apr. 1972 5 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 201, no. 4, 1971 p 837-839
(Contract NASw-2038)
(NASA-TT-F-14175) Avail: NTIS CSCL 08G

Cosmos 243 findings are presented for microwave radiation from the earth's surface, and soil temperature and moisture findings obtained by the Soviet Hydrometeorological Service to determine cultivated soil parameters, are discussed. The methodologies used are explained. Author

N72-20365# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTRON CONCENTRATION AND ELECTRON TEMPERATURE MEASUREMENT IN THE IONOSPHERE BY PROBE METHODS
Iv. B. Burakov, G. P. Komrakov, I. V. Popkov, V. G. Khriukin, and Iu. K. Chasovitin 12 Mar. 1970 5 p refs Transl. into ENGLISH from Geomagn. Aeron. (Moscow), v. 11, no. 6, 1971

p 1105-1107
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Two rocket experiments were conducted to measure electron concentration and electron temperature in the ionosphere. A high frequency impedance probe and a cylindrical Langmuir probe were used for the measurements. The electron concentration profiles are presented for the 77 to 170 km altitude range. Electron temperature profiles cover the altitude range 85 to 174 km. An estimate was made of the rate of heat influx to an electron gas, due to the kinetic energy of photo electrons originating during ionization of the atmosphere by shortwave solar radiation. K.P.D.

N72-20366# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHOCKWAVE IN THE MAGNETOSPHERE TAIL AS THE REASON FOR THE ACTIVE PHASE OF A MAGNETOSPHERE SUBSTORM
V. B. Liatskii and Iu. I. Maltsev 6 Apr. 1970 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 11, no. 6, 1971 p 1038-1043
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A mechanism which causes the impulsive collapse of magnetic lines of force stretched out from earth, propagates into the magnetosphere tail and causes a magnetospheric substorm, is proposed. The mechanism is based on the excitation of a shock wave in a neutral layer of the magnetosphere tail by a magnetized solar wind inhomogeneity moving sufficiently rapidly and in a definite manner. Author

N72-20367# Institut d'Aeronomie Spatiale de Belgique, Brussels.
DETERMINATION OF THE VERTICAL DISTRIBUTION OF STRATOSPHERIC METHANE USING BALLOON-BORNE INFRARED SPECTROMETERS [DETERMINATION DE LA DISTRIBUTION VERTICALE DU METHANE STRATOSPHERIQUE PAR SPECTROMETRIE INFRAROUGE EN BALLON]
M. Ackerman, D. Frimout, C. Lippens, and C. Muller 15 Apr. 1972 16 p refs In FRENCH; ENGLISH summary
(Aeronomica-Acta-A-97) Avail: NTIS

Solar spectra are presented which were recorded by a balloon-borne spectrometer over the 3 to 4 micron wavelength range at solar zenith angles between 75 and 95 deg at an altitude of 34 km. The mixing ratio of methane between 16 and 33 km, which was deduced from the measurements, decreases in the stratosphere. These observational results confirm conclusions drawn from sampling experiments made at altitudes up to 23 km, showing that the mixing ratio decreases by a factor of about 3 between the tropopause at 13.5 km and 33 km in the stratosphere. Author

N72-20368*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RELATION OF THE EUROPEAN DATUM TO A GEOCENTRIC REFERENCE SYSTEM
J. G. Marsh, B. C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.), and S. M. Klosko (Wolf Res. and Develop. Corp., Riverdale, Md.) Oct. 1971 24 p refs Presented at Intern. Union of Geodesy and Geophys. Meeting, Moscow, Aug. 1971
(NASA-TM-X-65855; X-553-71-427) Avail: NTIS CSCL 08B

Over 31,000 precision reduced optical observations of GEOS-1 and 2 in 70 two-day orbital arcs were used at Goddard Space Flight Center (GSFC) in a dynamical solution to determine center-of-mass coordinates for 15 tracking stations on the European Datum. Comparisons with the results obtained at Centre National d'Etudes Spatiales (CNES) give agreement of about 1.5 ppm for chord lengths. After considering a scale correction to the European Datum (ED) of 1950 to account for the absence of geoid heights at the time of its reduction, agreement to a few ppm between the CNES/GSFC and the ED chords is obtained. However, a small systematic difference between survey and satellite results remains for stations in southeastern France and Switzerland. Author

N72-20369*# Northrop Corp., Huntsville, Ala. Electro-Mechanical Div.
EMPIRICAL ANALYTIC TRANSFORMATIONS BETWEEN GEOGRAPHIC AND CORRECTED GEOMAGNETIC COORDINATES
R. H. Comfort Jul. 1970 58 p refs
(Contract NAS8-20082)
(NASA-CR-123592; M-793-765) Avail: NTIS CSCL 08B

Based upon a mathematical model of contours of constant corrected geomagnetic latitude in a polar projection of geographic coordinates, analytic equations are developed for converting geographic coordinates to corrected geomagnetic coordinates and vice versa. The equations were programmed for use on a small computer. This treatment is restricted to the Northern Hemisphere. Author

N72-20370*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTERPLANETARY MAGNETIC SECTOR POLARITY INFERRED FROM POLAR GEOMAGNETIC FIELD OBSERVATIONS
Eigil Friis-Christensen (Danish Meteorol. Inst., Charlottenlund), Knud Lassen (Danish Meteorl. Inst., Charlottenlund), John M. Wilcox (Calif. Univ., Berkeley), Walter Gonzalez (Calif. Univ., Berkeley), and David S. Colburn 1971 10 p refs *Its* Geophys. Medd. Nr.R-26 Prepared in cooperation with the Danish Meteorol. Inst., Charlottenlund Sponsored in part by ONR and NSF
(NASA-TM-X-67650) Avail: NTIS

In order to infer the interplanetary sector polarity from polar geomagnetic field diurnal variations, measurements were carried out at Godhavn and Thule (Denmark) Geomagnetic Observatories. The inferred interplanetary sector polarity was compared with the polarity observed at the same time by Explorer 33 and 35 magnetometers. It is shown that the polarity (toward or away from the sun) of the interplanetary magnetic field can be reliably inferred from observations of the polar cap geomagnetic fields. ESRO

N72-20371# Brookhaven National Lab., Upton, N.Y.
ECOLOGICAL EFFECTS OF ENERGY: A BASIS FOR POLICY IN REGIONAL PLANNING
G. M. Woodwell and C. A. S. Hall [1971] 15 p refs
(BNL-16228) Avail: NTIS

The ecological effects of energy and establishment of a basis for policy in regional planning are discussed. It is determined that the maintenance of the physical, chemical, and biotic integrity of the environment, regionally and earth wide, is a major consideration in planning any human activity and especially in planning for energy. Stability is an objective because the alternative, progressive degradation of the environment, is unacceptable. A wide spectrum of new laws governing the ecology may be required to produce the desired results. Author

N72-20372# European Space Research Inst., Frascati (Italy).
HYDROSTATIC EQUILIBRIUM IN THE TERRESTRIAL MANTLE AND THE STRUCTURE OF THE CORE
Dennis Parkinson and George H. A. Cole (Hull Univ., Engl.) [1971] 14 p refs Submitted for publication
Avail: NTIS

The structure of the interior of the earth was deduced from the analysis of seismic events of various origins. Both natural and artificial seven broad regions were identified (regions A-G) with E, F, and G less known than the remainder. In order to verify the assumption of hydrostatic equilibrium for the whole interior below the A region as a means of elucidating elastic conditions within the core, a polytropic-type equation of state along with the equations of hydrostatic equilibrium are used. Some numerical results are set out. It is concluded that agreement with results of seismological studies may be obtained. ESRO

N72-20373# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Mar. 1971 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL MARS 1971]
1971 28 p In FRENCH and DUTCH
Avail: NTIS

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during March 1971 are presented. ESRO

N72-20374# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 70/10-12, OCTOBER - DECEMBER 1970
L. Liszka, ed. [1971] 148 p
Avail: NTIS

Results of ground based measurements of upper atmospheric variables made at Kiruna, Sweden are listed for October to December 1970. Recorded data includes K indices, magnetic pulsations, standard magnetograms and atmospheric absorption. ESRO

N72-20375# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jul. 1971 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, JUILLET 1971]
1971 32 p In FRENCH and DUTCH
Avail: NTIS

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for July 1971. ESRO

N72-20376# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
THE RELATIONSHIP BETWEEN MICROSCALES AND WIND-WAVE SPECTRAL DEVELOPMENT Ph.D. Thesis
Craig E. Dorman Nov. 1971 194 p refs
(Contract N00014-67-A-0204-0024; NR Proj. 083-236)
(AD-734669; Rept-71-6) Avail: NTIS CSCL 08/3

The objective of this study was to describe the mechanics of wind-wave generation and spectral development. Intermittency, high frequency microstructure in wind and wave fields, and strong nonlinear coupling involving a wide range of scales are shown to be crucial elements in the transfer of momentum to, from, and within the wave field. None of these elements are included in available theories. Measurements of wave height and of the turbulent atmospheric and subsurface boundary layers were made from a small surface following platform and from a stable 38.5m spar buoy. The structure of moving gust patterns (cat's paws) is described and related to the generation of surface waves. Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-20377 National Lending Library for Science and Technology, Boston Spa (England).
DOSE RATE METER FOR MEASURING ENVIRONMENTAL RADIATION
W. Kolb and U. Lauterbach [1971] 9 p refs Transl. into ENGLISH from Proc. of Intern. Symp. on Rapid Methods for Meas. of Radioact. in the Environ., Munich, 5-9 Jul. 1971 (NLL-CE-Trans-5813-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An easily portable instrument is described for measuring gamma radiation dose rates of the order of magnitude of the natural environmental radiation and below. A scintillation combination was used as the detector, giving readings within 10% and having five measurement ranges from 1 to 100 uR/h full scale deflection. Author

N72-20378 British Broadcasting Corp., Kingswood (England). Research Dept.
A MEDIUM-WAVE FIELD-STRENGTH MEASURING RECEIVER
D. E. Susans, R. D. C. Thoday, and M. J. Buckley 1972 8 p (BBC-1972/1; RA-93) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A field strength measuring system is described for the frequency range 510 to 1610 kHz. It incorporates a commercially available receiver, with some modifications. The loop aerial used with this receiver is mounted on the roof of a metal-bodied vehicle. The calibration arrangement, using a specially constructed unit with an oscillator, permits the receiver to give direct readings of the field strength over the range 30 microvolt/m to 10 V/m. The overall error, including that due to arbitrary orientation of the vehicle, is less than + or - 10%. Author

N72-20379* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROLL ALIGNMENT DETECTOR Patent
Clarence Cantor and Irving B. Lowen, inventors (to NASA) Issued 25 Jan. 1972 28 p Filed 31 Oct. 1969 Supersedes N70-20680 (08 - 08, p 1445)
(NASA-Case-GSC-10514-1; US-Patent-3,637,312; US-Patent-Appl-SN-873045; US-Patent-Class-356-152; US-Patent-Class-356-138; US-Patent-Class-250-208) Avail: US Patent Office CSCL 14B

A method and apparatus is described measuring roll misalignment of a test body with respect to a reference body. Two light sources are provided on the test body. The light sources are focused on a rotating disk and the light images are intercepted by an aperture on the rotating disk to illuminate detectors behind the disk. Measurement of angular displacements at the times of detector illumination indicates roll misalignment of the body being tested. Accurate roll misalignment is measured even in the event that the body is displaced laterally in addition to angularly about the light of sight. The geometry enabling this apparatus to be insensitive to lateral displacements is presented. Official Gazette of the U.S. Patent Office

N72-20380* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STEREO PHOTOMICROGRAPHY SYSTEM Patent
Walter F. Lindsey, inventor (to NASA) Issued 14 Dec. 1971 6 p Filed 27 Mar. 1969
(NASA-Case-LAR-10176-1; US-Patent-3,626,828; US-Patent-Appl-SN-811038; US-Patent-Class-95-18) Avail: US Patent Office CSCL 14E

A stereo photomicrography system is described having a stereo microscope capable of viewing a specimen at various magnifications. The system includes: (1) a stereo camera which can be optically aligned with the stereo microscope; (2) a focusing microscope with a very shallow depth of field and adjustable to focus on a reticle place at the film plane of the stereo camera; (3) a specimen holder with height adjustment and an indicating mechanism for producing readings of the height of the specimen; and (4) a photometer which can be utilized to measure the light intensity in the specimen image of the film plane. In using the equipment, the light intensity for a particular focus is accurately ascertained and this data is used in conjunction with specimen height and film speed to provide an exposure setting which results in sharp and clear stereo microphotos. D.L.G.

N72-20381* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC DUST SENSOR Patent
Otto E. Berg, inventor (to NASA) Issued 7 Dec. 1971 7 p
Filed 31 Dec. 1968
(NASA-Case-GSC-10503-1; US-Patent-3,626,189;
US-Patent-Appl-SN-789044; US-Patent-Class-250-83.6R) Avail: US Patent Office CSCL 14B

A sensor is described for detecting and measuring the energy, velocity, and direction of travel of a cosmic dust particle. The sensor system consists of two arrays of electrodes, arranged in columns and rows, through which a cosmic particle may traverse. Each electrode contains electrically biased conductor layers supported on an optically transparent matrix. Ions and electrons from an impacting cosmic dust particle are collected on the conductor layers and an electrical output pulse is produced. A particle penetrating the first array of electrodes and impacting upon the second array produces a pair of electrical outputs with a time spacing proportional to the velocity of the particle. The direction of the particle's travel is determined by the alignment of respective sectors traversed by the particle. Behind the second array of electrodes is a microphone plate which arrests further penetration of the particle. The microphone output amplitude is an indication of the particle's momentum. D.L.G.

N72-20382*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO/SATURN 5 CONSOLIDATED INSTRUMENTATION PLAN FOR AS-511 (APOLLO 16)
D. E. Clark 25 Feb. 1972 81 p
(NASA-TM-X-67661) Avail: NTIS CSCL 14B

The consolidated instrumentation plan, for employing optical and electronic data acquisition systems to monitor the performance and trajectory of Apollo Saturn 5 vehicle 511 during the launch phase of the mission (prelaunch, liftoff to insertion), is presented. Telemetry, optical, and electronic tracking equipment on board the vehicle and data acquisition systems monitoring the flight are discussed. Flight safety instrumentation, vehicle data transmission systems, and geophysical instrumentation are also described.
Author

N72-20383*# California Univ., Riverside. Dept. of Physics.
A LARGE AREA DETECTOR FOR NEUTRONS BETWEEN 2 AND 100 MeV
R. T. Grannan, R. Koga, W. A. Millard, A. M. Preszler, G. M. Simnett, and R. S. White 1 Feb. 1972 33 p refs
(Grant NGR-05-008-022; Contracts N00014-69-A-0200-5001; N00014-69-A-0200-5004; F29601-69-C-0029)
(NASA-CR-125913; IGPP-UCR-72-2) Avail: NTIS CSCL 14B

A neutron detector sensitive from 2 to 100 MeV is described. The detector is designed for high altitude balloon flight to measure the flux, energy and direction of albedo neutrons from the earth and to search for solar neutrons. A neutron scatter from a proton is required in each of two liquid scintillator tanks spaced 1 meter apart. The energy of the recoil proton in the first tank is obtained from pulse height analysis of the scintillator output. The energy of the recoil neutron is obtained from its time of flight between the tanks. The detector has been calibrated with 15.3 MeV neutrons and mu mesons. The minimum detectable flux is 10(-4) neutron/sq cm/sec at a counting rate of one per minute; the energy resolution is 12% at 15 MeV and 30% at 100 MeV. The angle between the incoming neutron and the recoil neutron is measured to + or - 10 deg.
Author

N72-20384# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
PRECISION MEASUREMENT AND CALIBRATION: VOLUME 8: SELECTED NBS PAPERS ON MECHANICS
Roscoe L. Bloss, ed. and Mary J. Zorloski, ed. Jan. 1972 566 p refs
(NBS-SP-300-Vol-8) Avail: SOD $6.25 as C 13.10:300/v.8

This volume is one of an extended series which brings together the previously published papers, monographs, abstracts, and bibliographies by NBS authors dealing with the precision measurement of specific physical quantities and the calibration of the related metrology equipment. The contents have been selected as being useful to the standards laboratories of the United States in tracing to NBS standards the accuracies of measurement needed for research work, factory production, or field evaluation. Volume 8 consists primarily of published works of the staff of the Mechanics Division of NBS. It includes papers in the fields of acoustics, fluid mechanics, force, gravity, humidity, pressure, strain, vacuum, vibration, and viscosity. Although most of the papers had been previously published, original papers in the fields of gravity and viscosity are included.
Author

N72-20385*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
ROCKET FLIGHT PERFORMANCE OF A PREPROTOTYPE APOLLO 17 UV SPECTROMETER S-169
William G. Fastie 3 Jul. 1971 97 p
(Contract NAS9-11528)
(NASA-CR-115469) Avail: NTIS CSCL 14B

The design, construction, testing, calibration, flight performance and flight data of an Ebert ultraviolet spectrometer are described which is an accurate representation of the conceptual design of the Apollo 17 UV spectrometer. The instrument was flown in an Aerobee 350 rocket from Wallops Island, Va., at 7:10 p.m. EDT on June 10, 1971 to an altitude of 328 km with a solar elevation angle of about 11 deg. Author

N72-20386*# Old Dominion Univ. Research Foundation, Norfolk, Va.
INVESTIGATION OF FACTORS AFFECTING THE HEATER WIRE METHOD OF CALIBRATING FINE WIRE THERMOCOUPLES
Edward G. Keshock [1972] 53 p refs
(Contract NAS1-9434-2)
(NASA-CR-112041) Avail: NTIS CSCL 14B

An analytical investigation was made of a transient method of calibrating fine wire thermocouples. The system consisted of a 10 mil diameter standard thermocouple (Pt, Pt-13% Rh) and an 0.8 mil diameter chromel-alumel thermocouple attached to a 20 mil diameter electrically heated platinum wire. The calibration procedure consisted of electrically heating the wire to approximately 2500 F within about a seven-second period in an environment approximating atmospheric conditions at 120,000 feet. Rapid periodic readout of the standard and fine wire thermocouple signals permitted a comparison of the two temperature indications. An analysis was performed which indicated that the temperature distortion at the heater wire produced by the thermocouple junctions appears to be of negligible magnitude. Consequently, the calibration technique appears to be basically sound, although several practical changes which appear desirable are presented and discussed. Additional investigation is warranted to evaluate radiation effects and transient response characteristics. Author

N72-20387# Technische Hochschule Munchen (West Germany).
THE HOLLOW CATHODE AS SPECTROCHEMICAL LIGHT SOURCE FOR ANALYSIS OF MINERAL- AND TRACE-ELEMENTS Ph.D. Thesis [DIE HOHLKATHODE ALS SPEKTROCHEMISCHE LICHTQUELLE ZUR ANALYSE VON MINERAL- UND SPURENELEMENTEN]
Rolf J. Werner 1971 92 p refs In GERMAN
Avail: NTIS

The application of the hollow cathode for a spectrochemical light source in the analyses of mineral and trace elements is described. The development of the hollow cathode with emphasis on the materials used and the photoelectric measurement principles are discussed. Techniques for conducting spectrochemical analyses of organic and inorganic substances are described. Line drawings of the hollow cathode instrument and associated electronic circuitry are provided. Transl. by P.N.F.

N72-20388# Technische Univ., Berlin (West Germany).
HIGHLY RESOLVING ELECTRON INTERFEROMETRY FOR VISUALIZATION OF SINGLE MAGNETIC FLUX QUANTA IN SUPERCONDUCTING MICROCYLINDERS Ph.D. Thesis [SICHTBARMACHUNG EINZELNER MAGNETISCHER FLUSSQUANTEN IN SUPRALEITENDEN MIKROZYLINDERN DURCH HOCHAUFLOESENDE ELEKTRONENINTERFEROMETRIE]
Burkhard Lischke 22 Jun. 1971 116 p refs In GERMAN
Avail: NTIS

Magnetic flux quantization in an extremely small cylinder is determined by measuring flux quantum and fluxoidal quantum values and their temperature dependencies by electron interferometry. The Aharonov-Bohm effect in the magnetic behavior of superconductors is also considered. Transl. by G.G.

N72-20389# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
ROTATIONAL TEMPERATURE MEASUREMENTS BY ELECTRON BEAM IN THE TEMPERATURE RANGE OF 500 TO 1200 K
G. Schweiger Oct. 1971 58 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-93) Avail: NTIS; DFVLR proz-Wahn: 17,30 DM

The reliability of the electron beam technique was investigated at different densities in the temperature range from 500 K to 1200 K. The experiments were carried out in air under static conditions. A systematic deviation between electron beam and thermocouple measurements was observed. A method for correcting the overlapping of R- and P-branch in the registered spectra is described. Using this method, the reduction of all line intensities was possible even at high temperatures, where the overlapping disturbs the line intensity considerably. The Muntz and the Hickman models were used for data reduction. Author

N72-20390# Australian Post Office Research Labs., Melbourne. Research Labs.
ELECTRICALLY SUPPRESSED ZERO VOLTMETER (48-53 VOLTS)
A. J. Stevens Apr. 1971 14 p refs
(Rept-6545) Avail: NTIS

A voltmeter was designed using a 1% meter movement and an electronic circuit to provide an instrument reading from 48 to 53 volts. Tests on the prototype showed an accuracy of better than + or - 0.25% between 20 and 160 F. Author

N72-20391*# Electronic Image Systems Corp., Boston, Mass.
DRYING APPARATUS FOR PHOTOGRAPHIC SHEET MATERIAL Patent Application
Paul Epstein, George Donovan, and Eric LaWhite, inventors (to NASA) Filed 12 Nov. 1971 16 p
(Contract NAS5-9647)
(NASA-Case-GSC-11074-1; US-Patent-Appl-SN-198362) Avail: NTIS CSCL 14E

An elongated drying chamber is provided with transport means for carrying photographic sheet material past a number of tubes that issue drying air streams directed against the liquiphilic surface of the sheet material. The tubes are slotted a distance equal to the width of the sheet material for complete, gentle drying by sheets of air. A common plenum supplies the tubes with heated air, the air being directed from the tube slots at an angle to the sheet surface to array the tubes close to the surface for maximum drying effect, while minimizing mechanical interference between the edges of the sheets and the slots in the tubes. The drive for the transport is housed in an enclosure between the plenum and the drying chamber and is provided with access through an overlying insulating chamber. An air return duct is provided along another side to complete insulation of the drying chamber from ambient conditions. Discharge openings for release or moisture laden air are the entrance and exit openings for the passage of sheet material. NASA

N72-20392*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MAXOMETERS, PEAK WIND SPEED ANEMOMETERS
John W. Kaufman, Dennis W. Camp, and Robert E. Turner, inventors (to NASA) 27 Dec. 1971 26 p
(NASA-Case-MFS-20916; US-Patent-Appl-SN-212165) Avail: NTIS CSCL 14B

Two forms of the invention are presented which are designed to register and maintain a fixed reading of peak wind speeds. One is for use under the most severe environmental conditions, while the other is for ambient environment. It comprises a cylinder enclosed in a suitable outer casing to withstand the conditions of usage, the casing and cylinder being provided at one end with a nose cap allowing projection through of a rod, bearing a pressure disk. Both embodiments are provided at the other end with a suitable closure, having an aperture in the severe environmental model through which will project a zero calibration mechanism. NASA

N72-20393*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVED COMPACT PRECISION ROTARY VANE ATTENUATOR Patent Application
Charles D. Stelzried, Tommy Y. Otoshi, David L. Nixon, and Robert W. Beatty, inventors (to NASA) Filed 29 Oct. 1971 10 p
(Contract NAS7-100)
(NASA-Case-NPO-11418; US-Patent-Appl-SN-193947) Avail: NTIS CSCL 14B

A rotary vane attenuator is described having a phase shift which is substantially constant over a relatively wide frequency band. The attenuator consists of two stators and an intermediary rotor, each with a resistive card. The rotor, in addition to the resistive card, includes an orthogonally positioned card of dielectric material which has no resistive film. NASA

N72-20394*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PHOTOGRAPHIC FILM RESTORATION SYSTEM Patent Application
Joseph L. Horner, inventor (to NASA) Filed 27 Dec. 1971 15 p
(NASA-Case-MSC-12448-1; US-Patent-Appl-SN-212010) Avail: NTIS CSCL 14E

A photographic film restoration system is described which may comprise a source of coherent light illuminating an exposed film having a fogged image thereon, a Fourier transform lens behind film, a spatial filter behind transform lens, another Fourier transform lens, behind the spatial filter, and an unexposed film for recording a corrected representation of the fogged image on the unexposed film. A total optical system is disclosed in which the spatial filter may comprise a photographic film whose transmittance characteristics increase the ratio of the zero to the higher spatial frequency components of images produced thereon by the system. An opto-electronic system is also disclosed in which the spatial filter is a part of a digital computer. NASA

N72-20395*# Honeywell, Inc., Minneapolis, Minn.
RADIANT SOURCE TRACKER INDEPENDENT OF NON-CONSTANT IRRADIANCE Patent Application
Fred D. Campbell, inventor (to NASA) Filed 28 Dec. 1971 21 p Prepared for JPL
(Contracts NAS7-100; JPL-951701)
(NASA-Case-NPO-11686; US-Patent-Appl-SN-212900) Avail: NTIS CSCL 14B

A tracker of a radiant source is described, comprised of a sectored matrix of detectors whose output voltages correspond to their respective levels of irradiance. The voltages are sampled during a variable length period and the resulting samples are shaped into triangular samples by an interfration process. They are supplied to a demodulator which provides an output corresponding to the difference of the time-voltage product of appropriate combinations of samples. The triangular samples are

also supplied to a demodulator whose output is an AGC voltage which is a function of the sum of the time-voltage integrals of the triangular samples. The AGC voltage is supplied to a pulse width modulator whose output controls the period of the voltage sample taken from each detector. NASA

N72-20396*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF FABRICATING AN ARTICLE WITH CAVITIES Patent Application
Walter J. Dale and George M. Jurscaga, inventors (to NASA) Filed 8 Feb. 1972 15 p
(NASA-Case-LAR-10318-1; US-Patent-Appl-SN-224489) Avail: NTIS CSCL 14B

A machining technique, using elastic mandrels, for producing an article with very thin bottom walls and cavities, is described. The article is prepared by fluid pressure bonding with rupture or distortion being prevented by the mandrel. The primary purpose of such a system is to study the surface temperature characteristics of various structures E.H.W.

N72-20397*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE MIRROR GLANCING INCIDENCE SYSTEM FOR X-RAY TELESCOPE Patent Application
Richard B. Hoover, inventor (to NASA) Filed 15 Feb. 1972 15 p
(NASA-Case-MFS-21372; US-Patent-Appl-SN-226477) Avail: NTIS CSCL 14B

An efficient high resolution optical system is described which employ grazing angle reflection suitable for soft X-ray observations. The system consists of a paraboloid mirror for receiving rays at a grazing angle, immediately followed by a hyperboloid mirror which receives reflections from the paraboloid at a grazing angle and directs them to a predetermined point of focus. A second hyperboloid mirror is centrally spaced between the other two surfaces and positioned to reflect, from its outer surface to the point of focus, the radiation which is reflected only by the initial hyperboloid. A shutter is included in the system to assist in calibration. D.L.G.

N72-20398*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPARATUS AND METHOD FOR MEASURING THE SEEBECK COEFFICIENT AND RESISTIVITY OF MATERIALS Patent Application
Vaclav Hadek, inventor (to NASA) Filed 26 Aug. 1971 18 p
(Contract NAS7-100)
(NASA-Case-NPO-11749; US-Patent-Appl-SN-175267) Avail: NTIS CSCL 14B

An apparatus is described for measuring thermoelectric properties of materials under high pressure. It includes a pair of force-transmitting assemblies constructed of thermally and electrically conductive material positioned between the ram and anvil of a press. Each such assembly has a small diameter, pressing portion for contact with one face of the sample, so the sample can be squeezed between them. Each assembly also includes a heat exchanger to maintain the sample face at a controlled temperature, and an electrical conductor to carry current generated by the sample. A sleeve of thermally and electrically insulative material surrounds the pressing portions of the two assemblies confining the sample and helping align the two pressing portions. A bellows surrounds the pressing portions of the assemblies and a vacuum pump can be used to evacuate the enclosed region. NASA

N72-20399*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT-TEST RESULTS FROM TWO TOTAL TEMPERATURE PROBES FOR AIR-DATA MEASUREMENTS UP TO 2014 K (3625 R)
Jack Nugent, Glenn M. Sakamoto, and Lannie D. Webb Washington Mar. 1972 53 p refs
(NASA-TN-D-6748; H-668) Avail: NTIS CSCL 14B

An experimental temperature probe package containing a fluidic oscillator temperature probe and a shielded thermocouple temperature probe was tested during several X-15 flights. The X-15 flights provided greatly varying test conditions, including a wide range of rapidly changing total temperatures and Mach numbers which extended from subsonic to hypersonic speeds. Within restricted ranges of free-stream Mach number, free-stream unit weight flow, and local stagnation pressure, both probes yielded ramp outputs of temperature parallel to ramp inputs of free-stream total temperature. Within these ranges both probes were used to determine total temperature in the Mach 6 temperature environment. Because ambient temperature was known, both probes were used to estimate velocity and Mach number. Author

N72-20400*# Translation Consultants, Ltd., Arlington, Va.
DISTANT-READING SOIL THERMOMETER
Ye. M. Grossman and A. V. Gudimenko Washington NASA Apr. 1972 6 p refs Transl. into ENGLISH from Meteorol., Klimatol. i Gidrol. (Kiev), no. 4, 1969 p 53-56
(Contract NASw-2038)
(NASA-TT-F-14161) Avail: NTIS CSCL 14B

The design and operation of the electric thermometer is described. The instrument possesses the following advantages: a high degree of accuracy (0.2 C) reliability, stability of parameters under long operation, and standardized sensors. Comparable continued operation of the instrument in natural field conditions provided gaged data for those measurements made by means of standard meteorological soil thermometers. Author

N72-20401*# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
SOME STUDIES ON THE BEHAVIOR OF W-RE THERMOCOUPLE MATERIALS AT HIGH TEMPERATURES
G. W. Burns and W. S. Hurst Feb. 1972 47 p refs
(NASA Order C-61545-B)
(NASA-CR-72884; Rept-2210414-2) Avail: NTIS CSCL 14B

Bare 0.25 mm diameter W-Re alloy thermoelements (W, W-3% Re, W-5% Re and W-25%) and BeO-insulated W-3% Re and W-25% Re thermoelements were examined for metallurgical, chemical and thermal emf changes after testing for periods up to 1000 hours at temperatures principally in the range 2000 to 2400 K. Environments for the tests consisted of high purity argon, hydrogen, helium or nitrogen gases. Commercially obtained bare-wire thermoelements typically exhibited a shift in their emf-temperature relationship upon initial exposure. The shift was completed by thermally aging the W-3% Re thermoelement for 1 hour and the W-25% Re thermoelement for 2 minutes at 2400 K in argon or hydrogen. Aged thermoelements experienced no appreciable drift with subsequent exposure at 2400 K in the gaseous environments. The chemically doped W3% Re thermoelement retained a small-grained structure for exposure in excess of 50 hours at 2400 K. BeO-insulated thermoelement assemblies showed varied behavior that depended upon the method of exposure. However, when the assemblies were heated in a furnace, no serious material incompatibility problems were found if the materials were given prior thermal treatments. Thermocouples, assembled from aged W-3% Re and W-25% Re thermoelements and degassed sintered BeO insulators, exhibited a drift of only 2 to 3 K during exposure in argon at 2070 K for 1029 hours. Author

N72-20402# Defence Standards Labs., Maribyrnong (Australia).
HIGHLY STABLE NICKEL BASE ALLOYS FOR THERMOCOUPLES
N. A. Burley Oct. 1971 30 p refs Prepared for presentation at 25th Ann. Conf. of the Australian Inst. of Metals, Brisbane, May 1972
(Rept-472) Avail: NTIS

The long-term thermal emf drifts are related to the

depletion of reactive solutes by oxidation, and the short-term changes to short-range ordering. It is shown that the environmental stability of nickel-base thermocouple alloys can be significantly enhanced by increasing solute levels above those required to cause a transition from internal to external modes of oxidation, and/or by selecting solutes which preferentially oxidize to form impervious diffusion barrier films. The short-term emf changes can be minimized by thermal treatments which stabilize the short-range order, or eliminated by the choice of solute levels at which structure-dependent emf changes are not evident. The formulation of two thermocouple alloys (Nicrosil/Nisil), whose compositions are based on the above consideration, is described. They are shown to be much more resistant to air oxidation and to have much higher thermal emf stabilities, and hence accuracies, than existing nickel-base thermocouple alloys. Author

N72-20403# Technische Hochschule Munchen (West Germany).
CONTRIBUTION TO THE TWO STEP EQUALIZATION OF A BLOCK SHAPED PHOTOGRAMMETRIC NET MODEL Ph.D. Thesis [BEITRAG ZUR ZWEISTUFENAUSGLEICHUNG EINES BLOCKARTIGEN PHOTOGRAMMETRISCHEN MODELLVERBANDES]
Manfred Stephani 13 May 1971 153 p refs In GERMAN
Avail: NTIS

Methods of photogrammetric block triangulation and block rectification with single models are discussed. The equalization in two steps for attitude and height separation was developed. Mathematical matrices are formulated to confirm the theoretical aspects of the photogrammetry process. Specific examples of photogrammetry are included to illustrate the various conditions which may be encountered and the methods recommended to produce rectification. Transl. by P.N.F.

N72-20404*# Kollsman Instrument Corp., Syosset, N.Y.
IMPROVED RITCHEY-CHRETIEN TELESCOPE Patent Application
Seymour Rosin and Max Amon, inventors (to NASA) Filed 29 Oct. 1971 16 p Sponsored by NASA
(NASA-Case-GSC-11487-1; US-Patent-Appl-SN-139814) Avail: NTIS CSCL 14B

A Ritchey-Chretien telescope is described which is responsive to images located off the telescope optical axis and includes transparent flat plate positioned in the ray path of the image. The flat plate has a tilt angle relative to the ray path to compensate for astigmatism introduced by the telescope. The angle of the plate is directly proportional to the off-axis angle of the image. The plate is comprised of two flat plates having opposite inclination to the ray path. A detector responsive to the optical image as transmitted through the flat plate is positioned approximately on the sagittal focus of the telescope. NASA

N72-20405*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTI-AXES VIBRATION FIXTURES Patent Application
Clifton R. Sims and Richard C. Taylor, inventors (to NASA) (Bendix Corp., Huntsville, Ala.) Filed 28 Dec. 1971 20 p
(NASA-Case-MFS-20242; US-Patent-Appl-SN-213004) Avail: NTIS CSCL 14B

A vibration fixture device, designed to determine the effects of vibration and the performance of vibration tests to meet certain prescribed standards, is described. The device is specifically designed to measure vibration along the orthogonal axes of a test specimen without moving or remounting the fixture. Items of various size and shapes may be measured. E.H.W.

N72-20406*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROMAGNETIC FLOW RATE METER Patent Application
Bruce A. Banks, inventor (to NASA) Filed 30 Dec. 1971 10 p
(NASA-Case-LEW-10981-1; US-Patent-Appl-SN-214089) Avail: NTIS CSCL 14B

The design and operation is described of a meter for measuring the flow rate of a liquid metal. The liquid metal whose flow rate is to be determined is directed through a chamber made of electrically-insulating material on which there is impressed a magnetic field perpendicular to the direction of flow of the liquid metal. The magnetic field is made to increase in strength in a downstream direction of the flow of liquid metal. Two or more electrodes are placed in the chamber traversely and perpendicular to the direction of flow and an ammeter is connected between the electrodes. The electrodes may be positioned in the top or the bottom of the chamber and each may be segmented. Oppositely placed electrodes may be used with at least one dividing wall extending from each electrode to cause reversal of the direction of flow of the liquid metal. The magnetic field may be provided by electromagnets or permanent magnets. Eddy currents resulting from the magnetic field gradient are collected and measured by the electrodes. The current measurement is directly related to the flow rate of the liquid metal. NASA

N72-20407*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MEASUREMENT SYSTEM Patent Application
John W. Turner, inventor (to NASA) Filed 7 Dec. 1971 17 p
(NASA-Case-MFS-20658; US-Patent-Appl-SN-205675) Avail: NTIS CSCL 14B

A system is described for measurement of a varying physical quantity represented by or converted to a variable frequency signal. Timing pulses are obtained marking the duration of a fixed number, or set, of cycles of the sampled signal and these timing pulses are employed to control the period of counting of cycles of a higher fixed and known frequency source. The counts of cycles thus obtained from the fixed frequency source provide a precise measurement of the average frequency of each set of cycles sampled, and thus successive discrete values of the quantity being measured. The frequency of the known frequency source is made such that each measurement is presented as a direct digital representation of the quantity measured. Author

N72-20408# Lockheed Missiles and Space Co., Palo Alto, Calif.
ACCELERATED PERIODIC ACTUATION OF A GROUND-BASED GYROCOMPASS
Iu. S Lukovatyi 1 Mar. 1971 4 p refs Transl. into ENGLISH from Izv. Vysshikh. Uchebn. Zavedenii Priborostr. (USSR), no. 12, 1971 p 69-72
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Accelerated actuation of a ground-based pendulum gyrocompass is considered, using the inertial moment originating in rotor acceleration as an external control. It was concluded that utilization of an inertial moment, originating during acceleration of a gyrocompass rotor, permits accelerated aperiodic movement at the meridian. In addition, the law of time variation of the kinetic moment which assures aperiodic motion is independe. t of the initial deviation of the sensor from the meridional plane. K.P.D.

N72-20409# Danish Meteorological Inst., Charlottenlund.
BIBLIOGRAPHY OF FLUXGATE MAGNETOMETERS
F. Primdahl 1971 16 p refs Reprinted from Publ. of the Earth Phys. Branch, v. 41, no. 1, of the Dept. of Energy, Mines, and Resources, Canada
(DMI-Geophys-Papers-R-22; ISBN-87-7478-039-5) Avail: NTIS

Papers on fluxgate magnetometers and closely related devices are listed. Most of the references include a short description of the contents under the following headings: type of sensor, theoretical calculations,experimental data, and instrument design and description. The major developments in the field from the early 1930's to the present are covered. Author

N72-20410# Bendix Corp., Kansas City, Mo.
RAPID VISUAL SCANNING SYSTEMS FOR PCB'S, FY71-2 Quarterly Report
R. D. Taylor Sep. 1971 17 p
(Contract AT(29-1)-613)
(BDX-613-527) Avail: NTIS

Two representative boards were carefully prepared to contain solder splatters. These solder targets were placed under components, on circuit paths, and on the epoxy portion of the board. The boards were then radiographed to give an indication of the effectiveness of X-ray technique. The test was successful, indicating that resolution is good enough to pick up metallic foreign material as small as 0.0015 inch in all locations except relatively high density areas. The next test phase was radiographing 29 product-guality PWA2 boards. Examination of radiographs revealed 3 to 12 apparent defects per board. Following a final cleaning process, the radiographs were compared to the boards. Sixty-six percent of the 84 incidences of metallic foreign material found on the boards were marked on the X-ray film and an additional 15 percent not marked were visible on the film upon closer examination. Nineteen percent of the metallic foreign material found on the boards was not identifiable on the X-ray film. Fifty-five percent of the apparent defects marked on the radiographs were found on the boards even though the boards had been through a final cleaning process after the film was taken. Author

N72-20411# Bendix Corp., Kansas City, Mo.
RAPID VISUAL SCANNING SYSTEMS FOR PCB'S, FY72-1 Quarterly Report
R. D. Taylor Aug. 1971 14 p
(Contract AT(29-1)-613)
(BDX-613-538) Avail: NTIS

A Zeiss operation microscope and a dual view compariscope were evaluated for their proficiency in performing visual inspections of printed circuit and printed wiring assemblies. The Zeiss microscope had very good optical quality, it was easy to operate, and it could inspect vertical components at 8 power. Many combinations of lenses could be used with the microscopes making it possible for the instrument to operate well from distances of 3 to 22 inches and from magnifications of 1 to 64 power. The compariscope's lighting system was not bright enough and produced shadowing in some places and glare in others. No vertical components could be checked on the apparatus. It was determined that the dual compariscope offered little if any improvement over the unaided eye. Author

N72-20412# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
INSTRUCTION MANUAL FOR DUAL DIGITAL STABILISER TYPE 241
E. R. Corran and C. G. Laman Mar. 1971 42 p
(AAEC/M-86) Avail: AEC Depository Libraries

A dual digital stabilizer was designed which can improve the stability and resolution of most commercially available multi-channel analyzers. Its construction and operation are described, together with the modifications necessary for its use with several common commercial analyzers. In its most versatile form the stabilizer can accommodate analyzers with up to 10,000 channels and with clock rates up to 20 MHz.
Author (NSA)

N72-20413# Central Research Inst. for Physics, Budapest (Hungary).
NEW EQUIPMENT FOR MEASURING STOCHASTIC PROCESS: STATISTICAL ANALYSER
Peter Pellionisz Aug. 1971 14 p refs
(KFKI-71-42) Avail: AEC Depository Libraries

The concept of a new statistical measuring set-up is presented. A family of plug-in instrument modules is described. With the set-up, it is possible to perform all the typical statistical measurements, such as signal recovery, amplitude and time analysis, correlation computing, etc. The most important types of statistical measurements are summarized; the aimed performance of the equipment are presented, and its application to statistical measuring problems is discussed. Author (NSA)

N72-20414# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre D'etudes Nucleaires.
READING OF RADIOLUMINESCENT DOSIMETERS
Roger Chenault and Raymond Prigent Oct. 1971 28 p In FRENCH
(CEA-R-4229) Avail: AEC Depository Libraries

This apparatus, especially designed for measurements on luminescence phenomena exhibited by LiF, can also be used with other radioluminescent materials (alumina, lithium borate). A feature is that low temperature luminous emission, which is a nuisance because of its instability, is eliminated; this is achieved by including a preheating region whose temperature and duration can be varied, which precedes the classical temperature rise while the measurements are made. A photomultiplier is included with an 800 to 1300 volt integrated transistorized e.h.t., which delivers between 10 to the minus 9th power A and 10 to the minus 4th power A according to the luminous intensity delivered by the dosimeter. The experimental results are delivered in an analog or digital form (automatic commutation of sensitivity ranges, possibility of printing out the results). Two principles of operation are simultaneously assured: either the production of a spectral curve (from the photomultiplier output current) and integration of this current, or the production of a spectral curve and measurement of the peak current value (displayed and stored in a memory). Author (NSA)

N72-20415# Japan Atomic Energy Research Inst., Tokyo.
MEASUREMENTS OF NONLINEARITY AND DETECTION EFFICIENCY OF A Ge(Li) SPECTROMETER
Takao Tojo, Makoto Kondo, Tadao Shiraishi, Katsuji Sezaki, and Isao Shoji Aug. 1971 34 p refs In JAPANESE
(JAERI-Memo-4560) Avail: AEC Depository Libraries

In the measurement of the nonlinearity of a standard amplifier-analyzer system, two methods were used. One is the so-called gamma ray method, using the gamma rays of 38 different energies emitted from 12 nuclides, up to 3548 keV of Co-56 and other is the mercury relay pulser method. The nonlinearity of other spectrometer systems, in which only the standard system linear amplifier was replaced by other amplifiers of 3 different types, and also that of the analyzer were measured by the pulser method. The results are shown as the deviations from linearity obtained by linear fitting of the data. In all the measurements, the nonlinearities were less than 0.1 percent. Absolute full energy peak efficiencies were determined for the different gamma ray energies, with the source distance of 5 cm, by using the same gamma ray sources as for nonlinearity measurements. The gamma ray energies of useful sources for the energy calibration of a Ge(Li) spectrometer are listed in the Appendix. Author (NSA)

N72-20416# Kernforschungsanlage, Juelich (West Germany).
COMPUTER CONTROLLED TRIPLE AXIS NEUTRON SPECTROMETER WITH CAMAC INSTRUMENTATION
K. Zwoll, H. H. Schmidt, and K. D. Mueller Jun. 1971 64 p refs
(JUL-774-ZE-FF) Avail: AEC Depository Libraries

The electric and electronic components of the triple axis neutron spectrometer operated by a PDP 8/I computer at the DIDO Reactor of the KFA Juelich are described in detail. The communication between computer and experimental process is carried out via CAMAC instrumentation. Its flexibility and expandability, particularly in a laboratory environment, are demonstrated. Author (NSA)

N72-20417# European Organization for Nuclear Research, Geneva (Switzerland).
SCINTILLATION HODOSCOPE WITH LIGHT CODING
A. P. Burgorskii, A. A. Borisov, A. A. Derevshchikov, Yu. A.

Matulsnko, A. P. Meshchanin, S. B. Nurushev, V. L. Solovyanov, L. F. Solevev, E. V. Smirnov, V. V. Siksin et al Jan. 1972 13 p refs Transl. into ENGLISH of Gos. Kom. po Ispolz. At. Energii SSSR, report IFVE-70-50
(CERN-Trans-71-27; IFVE-70-50) Avail: AEC Depository Libraries

The design and operation of a hodoscope composed of an optically coded array of scintillation detectors are briefly described. NSA

N72-20418# Academy of Sciences of the Armenian SSR, Erevan (USSR).
STUDY ON THE WIDE GAP SPARK CHAMBER WITH A LOW SUPPLY TENSION
K. M. Avakian, R. B. Ajvazian, E. M. Matevosian, and V. M. Krishtchyan 1970 10 p In RUSSIAN; ENGLISH summary
(EFI-ME-5(70)) Avail: AEC Depository Libraries

A wide gap spark chamber with two gaps 15 cm each with an electric field of 1.5 kV/cm was studied. It was found that in such a chamber the spark follows the track of a particle with high accuracy and has high brightness which permits the use of a small aperture when making photographs. Author (NSA)

N72-20419# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
FUNCTIONAL PRINCIPLES OF A MODULATING ANALYZER FOR BUBBLE CHAMBER PICTURES
S. N. Sokolov and B. A. Utochkin 1970 16 p refs In RUSSIAN
(IFVE-SVM-70-76) Avail: AEC Depository Libraries

Functional principles of a new device, called a modulating analyzer, for handling bubble chamber pictures are described. The device is used to determine the parameters of a particle trajectory in the bubble chamber by direct interposition of the track image on the trajectory projection model, measurements of coordinates of separate points (bubbles) being omitted. The blockdiagram of the device and its peculiar units such as a modulating cathode ray tube and the channel that generates an agreement signal are given. The possible operational logics of the device is explained. Author (NSA)

N72-20420# California Univ., Livermore. Lawrence Radiation Lab.
METAL-OXIDE-SEMICONDUCTOR X-RAY DETECTORS
D. R. Ciarlo, R. Kalibjian, K. Mayeda, and T. A. Boster 8 Oct. 1971 16 p refs Presented at IEEE 1971 Nucl. Sci. Symp., San Francisco, 3 Nov. 1971 Sponsored by AEC
(UCRL-73222; Conf-711111-9) Avail: NTIS

Metal-oxide-semiconductor (MOS) devices were used for detecting low-energy (2 to 20 keV) x rays for incident fluences of 0.0001 to 0.1 cal/sq cm (or dosage in the device of 1,000 to 1,000,000 rads) in a bent-crystal spectrometer application. An attractive feature of the detector is that the three functions of (1) detection, (2) memory, and (3) readout are integrated into one semiconductor chip. Author (NSA)

N72-20421# California Univ., Livermore. Lawrence Radiation Lab.
MAGNETIC THIN-FLIM RECORDING SYSTEM FOR FAST TRANSIENTS IN NUCLEAR DIAGNOSTICS
R. Wichner, E. Fischer-Colbrie, R. W. Buntenbach, G. A. Condas, E. J. Hsieh, R. P. Rufer, K. E. Vindelov, J. W. Winslow, D. W. Brown, and L. R. Mendonca 21 Oct. 1971 26 p refs Presented at Nucl. Sci. Symp., San Francisco, Calif., 3 Nov. 1971
(UCRL-73236; Conf-711111-13) Avail: NTIS

The development of a fast transient recording system is described. A magnetic thin film is used to record an electrical signal in the form of a domain wall. The recorder has a risetime on the order of a nanosecond and a dynamic range of better than 30 dB. Readout of the record is compatible with computer (megabit) cycle times. Author (NSA)

N72-20422# Oak Ridge Gaseous Diffusion Plant, Tenn.
NEW METHODS FOR INTERPRETING NEUTRON DATA OBTAINED FROM Y-12 NUCLEAR ACCIDENT DOSIMETER, ORGDP FILM BADGE, AND HURST THRESHOLD DETECTOR UNIT
J. C. Bailey 15 Oct. 1971 46 p refs
(Contract W-7405-eng-26)
(K-1821) Avail: NTIS

Basic experimental information on which these improved interpretation methods are based was obtained through the use of a new dosimeter developed at ORGDP. The data interpretation methods were applied to dosimeter data obtained through the exposure of dosimetry units and phantoms, simulating human exposures, to radiation from the Health Physics Research at the Oak Ridge National Laboratory under four different shielding configurations, which provided widely different spectra. Neutron dose values determined with a Hurst absolute proportional counter served as the basis of comparison for all units. With a single exception involving a very heavily shielded configuration, dose values derived from film badges on the phantoms facing the reactor were accurate to within 22%. These determinations included badge which were shielding from the reactor by the phantoms. All of the dosimeters yielding dose values which were biased low by about 25% for phantoms turned with a side toward the reactor, a result considered to be consistent with a lower effective dose for a side exposure due to the higher degree of self-shielding of the body. Author (NSA)

N72-20423# Oak Ridge National Lab., Tenn.
BROADBAND CURRENT PREAMPLIFIER CONFIGURATION FOR OBTAINING HIGH RESOLUTION ENERGY AND TIME INFORMATION FROM NUCLEAR RADIATION DETECTORS
J. K. Millard, T. V. Blalock (Tenn. Univ., Knoxville), and N. W. Hill 1971 13 p refs Presented at Nucl. Sci. Symp., San Francisco, 3 Nov. 1971 Sponsored by AEC
(Conf-711111-5) Avail: NTIS

A broadband current preamplifier was developed to complement nuclear spectroscopy systems requiring linear gating. The preamplifier stage configuration consists of an FET input, a broadband interstage current gain section, and a high-impedance feedback network. The preamplifier produces a noise line width comparable to charge-sensitive designs having similar parameters. Because of large bandwidths and low-nose performance, the preamplifier, connected directly to a fast leading-edge discriminator, generates very accurate timing data. A preamplifier consisting of three gain stages was built and subsequently tested with Ge(Li) detectors. This preamplifier had a current gain of 10,000, a rise time of 8 nsec with a 10 pF detector capacitance, and a 0-pF noise line width, using an RC-RC ungated filter, of 1.4 keV (fwhm Ge). With the preamplifier operating from a 10 cc Ge(Li) coaxial detector, timing experiments utilizing the Co-60 gamma cascade indicated resolutions as low as 1.15 nsec fwhm. Author (NSA)

N72-20424# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MULTIPLEX MAGNETIC SPECTROMETER OF CHARGED PARTICLES
L. M. Soroko 1971 10 p refs In RUSSIAN
(JINR-P13-6032) Avail: AEC Depository Libraries

The construction of the multiplex magnetic spectrometer of charged particles is described. The principle of operation is given and its advantages, compared to the traditional spectrometer scheme, are pointed out. The algorithm of the data processing is formulated. Author (NSA)

N72-20425# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ELECTROSTATIC ANALYZER FOR PARTICLES OF VERY LOW ENERGY
J. Coutant 1971 8 p refs In FRENCH Presented at the 3d Intern. Symp. on Molecular Jets, Cannes, France, 29 Jun. -

2 Jul. 1971
(CEA-Conf-1818; Conf-710629-1) Avail: AEC Depository Libraries

An electrostatic analyzer was developed for granules or molecular clusters containing up to a few thousand hydrogen or nitrogen atoms. These granules are formed by condensation in a supersonic jet and ionized by electron bombardment. The jet is monokinetic and the mass distribution analysis is equivalent to an energy distribution analysis. The particle energy lies between 0.05 and 200 eV for granules containing 20 hydrogen atoms and 20,000 nitrogen atoms respectively. The device consists of a cylindrical capacitor. The outer cylinder has two slits parallel to its axis and which serve as the entrance and exit for the beam. A positive ion entering the field is deflected forwards the external electrode which it meets at a point depending on its energy and its initial direction. Author

N72-20426# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
H.I.B. DIGITAL RATEMETER
J. Fuks 24 May 1971 43 p In FRENCH
(CEA-N-1493; Rept-2298(SER)1530) Avail: AEC Depository Libraries

An H.I.B. digital ratemeter is described including the ratemeter module, converter module, alarm-trigger module, power supply, and connection to the distribution system. The main characteristics of the apparatus and the specifications of the various components are given. NSA

N72-20427# Tyco Labs., Inc., Waltham, Mass.
CADMIUM TELLURIDE DETECTORS Interim Technical Report, 1 Jun. 1970 - 31 May 1971
F. Wald, R. O. Bell, and A. A. Menna Jul. 1971 102 p refs
(Contract AT(30-1)-4202)
(NYO-4202-1) Avail: NTIS

Topics discussed include the following: (1) Procedures for the reproducible synthesis and purification of CdTe are described. As a final step, solution purification using Te zones and RF heating is used. (2) Detailed analyses of THM growth of CdTe and attendant experimental results are given and the resulting furnace construction parameters are outlined. (3) Measurements on nuclear detectors are reported and limitations on gamma spectra are discussed. Material requirements are outlined and it is shown that besides high purity the compensation of native defect generated carriers is the major problem. A new model of In compensation in CdTe is presented which is felt to be useful in dealing with the native defect problem. Author (NSA)

N72-20428# Institute of Nuclear Techniques, Krakow (Poland).
PARAMETERS OF THE ELECTRON-CAPTURE-TYPE BETA-IONIZATION DETECTORS DEVELOPED IN THE INSTITUTE NUCLEAR TECHNIQUES IN CRACOW
J. Lasa 1971 26 p In POLISH; ENGLISH summary
(ITJ-10) Avail: AEC Depository Libraries

The principles of operation and construction of the electron-capture-type beta-ionization detectors developed in the Institute of Nuclear Techniques are presented. The circuits of the measuring systems, as well as the recommendations concerning the carrier gas choice for these detectors are given. The working parameters of the detectors described are compared with those of those commercially available. Author (NSA)

N72-20429# Institut Franco-Allemand de Recherches, St. Louis (France).
ENERGETIC CALIBRATION OF DEVICES FOR MEASURING LIGHT [ENERGETISCHE EICHUNG VON LICHTMESSGERAETEN]
F. Roessler 12 May 1971 23 p refs In GERMAN
(Rept-8/71) Avail: NTIS

The conversion of light technical units into energetic units, i.e. photon numbers, is proposed for the calibration of photomultipliers used in upper atmosphere light measurements. The spectral distribution of the calibration lamp, which is a movie projector lamp, and the spectral sensitivity of the multiplier, are measured. The Rayleigh scattered light is also converted into the proposed units. The special case of a receiver with eye sensitivity is treated. ESRO

N72-20430# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab., Central De Recherches.
CHARGE DEPOSITION. ELECTROPHOTOGRAPHIC RECORDING PROCESSES SUITABLE FOR REAL TIME OPTICAL PROCESSING [DEPOT DE CHARGES. PROCEDE D'ENREGISTREMENT ELECTROPHOTOGRAPHIQUE ADAPTE AU TRAITEMENT OPTIQUE EN TEMPS REEL]
A. Jacques 5 Jul. 1971 32 p refs In FRENCH Sponsored by Direc. de Rech. et Moyens d'Essais
(LCR-DR-70-202/1/R) Avail: NTIS

A device was designed to transform to real time an electric signal into a proportional variation of the optical thickness of a film. Recording was performed by electro-optical photography in which the electric input signal controlled the electric charges deposited on the film. The film was then processed by running it through a tank containing optically dense particles. The corona device for creating changes and the processing method are discussed. It is found that the density distribution of charges on the film is random. Several improvements were tried but did not lead to a workable device. ESRO

N72-20431# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
AUTOMATIC SYSTEM WITH CURVE TRACER FOR TRANSFER OF OSCILLOGRAM DATA TO PUNCHED TAPE
Rolf B. Johansson Nov. 1971 46 p refs Partly in SWEDISH and partly in ENGLISH
(TRITA-EPP-71-25) Avail: NTIS

A system for the automatic transfer of oscillogram data to punched tape is described. Incorporating an automatic curve tracer and control by a program punched tape, the system has great flexibility in the choice of operation modes. The program tape also edits a typewritten output. In the automatic mode of operation, the system records the ordinates of the oscillogram at a preselected number of equidistant abscissa values. In the manual mode of operation, the points to be measured are freely selected by the operator. Semi-automatic modes are also available. By using the automatic curve tracer an analog signal, similar to the recorded signal, can be generated. Author (ESRO)

N72-20432# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Triebwerksmesstechnik.
TEMPERATURE DETERMINATION BY SPECTROSCOPY IN A HOT JET [SPEKTROSKOPISCHE TEMPERATURBESTIMMUNG IN EINEM HEISSGAS-FREI-STRAHL]
Rudolf Ferdinand Neubauer, Klaus Peter Anders, Huschang Modjallal, and Karl-Heinz Spiegel 1971 51 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-75) Avail: NTIS; DFVLR, Porz: 13 DM

In a hot jet, produced by arc heating of air, the temperature and the temperature profile are determined by using the intensity ratio of two spectral-lines of CuI. The particle density of the Cu-atoms is sufficiently constant within the measuring time and the used lines are optically thin. The copper vapor gets into the hot air because of erosion effects on the electrodes. The measured temperature (5500 + or - 250 K) is nearly constant over the cross section and there are only small differences between the temperature values regardless of whether or not the Abell inversion method is used. Author (ESRO)

N72-20433# Siemens A.G., Munich (West Germany). Zentral-Lab. fuer Nachrichtentechnik.
PHASE DIFFERENCE MEASUREMENT OF EXTREME ACCURACY FOR A RADIO INTERFEROMETER [PHASENDIFFERENZMESSUNG EXTREMER GENAUIGKEIT FUER EIN

RADIO-INTERFEROMETER]
H. Mahner Cologne DGLR 1971 34 p In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The feasibility of a radio-interferometer for satellite tracking with a bearing accuracy of 1 sec, and a phase measuring accuracy of 0.1 deg, is discussed. Solutions are given for: a measured data evaluation, with small signal to noise ratios and exact time assignment; the regulation of the receiving channels to constant phase measure, together with design criteria for the pilot frequency control system and the choice of pilot frequency spectra; and the feeding of the antennas with equal phase pilot signals. ESRO

N72-20434# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France).
PIEZOELECTRIC VIBRATION MEASUREMENTS ON TURBOMACHINE ROTORS WITH DIFFICULT ACCESS [MESURES PIEZOELECTRIQUES DE VIBRATIONS SUR LES ROTORS DE TURBOMACHINES DIFFICILEMENT ACCESSIBLES]
R. Holz Cologne DGLR 1971 23 p In FRENCH Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A method utilizing piezoelectric gages and capactive transducers for measuring the vibrations of turbomachinery blades is discussed. Research has shown that lithium metaniobiate is the most suitable crystal for applications at high temperature and high peripheral velocities and the method for growing suitable crystals is explained. Preliminary results are presented. ESRO

N72-20435# Fraunhofer Institut, Freiburg (West Germany).
INVESTIGATIONS OF THE PRESSURE PROFILE AT THE END PLATE OF AN AIR DRIVEN DIAPHRAGM SHOCK TUBE [UNTERSUCHUNGEN UEBER DEN DRUCKVERLAUF AN DER ENDPLATTE EINES LUFTBETRIEBENEN MEMBRAN-STOSSROHRES]
G. Guerke, H. Reichenbach, and G. Schwarzkopf Bonn Bundeswehramt 1971 41 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung (BMVG-FBWT-71-27) Avail: NTIS; Bundeswehramt Bonn: 25 DM

Under certain conditions, the maximum pressure at the end-plate of a diaphragm-shock-tube is higher than the theoretical pressure of a reflected shock wave. The reason is that there are multiple reflections at the contact-surface. The pressure profile at the end-plate of a shock-tube was therefore investigated experimentally and theoretically in the pressure range for simulators. The conditions for the design of shock-tubes without these unwanted pressure rises are discussed. Author (ESRO)

N72-20436# Fraunhofer Institut, Freiburg (West Germany).
AN OPTICAL SYSTEM FOR OBSERVATIONS IN A SPHERICAL SHELL [EIN OPTISCHES SYSTEM FUER BEOBACHTUNGEN IN EINEM KUGELFOERMIGEN RAUM]
E. Guenther Bonn Bundeswehramt 1971 23 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung (BMVG-FBWT-71-28) Avail: NTIS; Bundeswehramt Bonn: 25 DM

An optical system is described for observation of implosion of detonable gas mixtures in a closed spherical shell. The central field of view has a diameter of 3.5 cm, and the interior diameter of the sphere is 14 cm. The results of an approximation calculation, in which the special requirements of the optical system are taken into account, are discussed, and the design of the optical parts of the system is described. ESRO

N72-20437# Technische Univ., Berlin (West Germany). Inst. fuer Flugfuehrung und Luftverkehr.
STABILIZATION AND GUIDANCE OF VEHICLES USING INDICATING INSTRUMENTS. PART 2: ABOVE THE GROUND INDICATION AND ARTIFICIAL HORIZON [STABILISIERUNG UND LENKUNG VON FAHRZEUGEN MIT HILFE DER VORANZEIGE. TEIL 2: UEBERGRUNDANZEIGE UND KUENSTLICHER HORIZONT]
Dieter Dey and Gunnar Johannsen Feb. 1971 93 p refs In GERMAN
(Rept-61) Avail: NTIS

An indicating instrument, the main part of which is the display of an extrapolated trajectory element, has been developed, simulated and investigated for the above-the-ground motion of a VTOL aircraft. The improvements acquired from using this pre-indication are depicted by spectral density and power density functions. The results show that the indicator simplifies manual control of the above-ground motion of a hovering aircraft. In addition, an artificial horizon indicating extrapolated position, has been developed for manual position control of a hovering VTOL aircraft. The results show that the extrapolated horizon line simplifies control, shortens learning time, and augments control quality. ESRO

N72-20438# Entwicklungsring Nord, Bremen (West Germany).
TELEOPERATOR SYSTEM STUDY Summary Report
Dec. 1971 144 p refs
(Contract ESTEC-1436-71-EL)
Avail: NTiS

The design of an unmanned space module with manipulator arms, remotely controlled from an earth or spaceborne control station, for orbital satellite inspection, maintenance, and repair, is reported. Special emphasis is placed upon the construction of the manipulator arms and end-effectors. The system is intended for use in conjunction with the post Apollo program-shuttle, tug, space station, in order to avoid extravehicular activity. ESRO

N72-20439# Defence Research Information Centre, Orpington (England).
GAS ANALYZER AND VELOCITY TRANSDUCER OF GAS FLOW USING FLUIDIC ELEMENTS
L. D. Vaganova Jan. 1972 10 p refs Transl. into ENGLISH from Unidentified Russian mono (Moscow), 1970 p 332-336 (AD-734806; DRIC-Trans-2609; DRIC-BR-27708) Avail: NTIS CSCL 13/12

The report presents the description of a methane-air mixture analyzer and a velocity transducer of gas flow using fluidic elements, for coal mine safety engineering. GRA

N72-20352*# California Univ., Davis. Dept. of Agricultural Engineering.
INVESTIGATION OF ATMOSPHERIC EFFECTS IN IMAGE TRANSFER
K. L. Coulson and R. L. Walraven *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Devices 1 Jan. 1972 16 p Original contains color illustrations (See N72-20343 11-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

N72-20783*# Techtran Corp., Glen Burnie, Md.
CERENKOV DETECTORS WITH HIGH EFFECTIVE AREA
A. M. Abdullayev, S. A. Azimov, E. Mulladzhanov, A. Sadykov, and T. S. Yuldashbayev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 109-115 refs (See N72-20774 11-29)
Avail: NTIS CSCL 14B

N72-20868*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONVECTIVE HEATING MEASUREMENT BY MEANS OF AN INFRARED CAMERA
Dale L. Compton *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 645-660 ref (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-20440 National Lending Library for Science and Technology, Boston Spa (England).
METALLURGICAL AND PHYSICAL PRINCIPLES OF PRESSURE WELDING
F. Erdmann-Jesnitzer [1957] 23 p refs Transl. into ENGLISH from Aluminum (Dusseldorf), v. 33, Nov. 1957 p 730-739
(NLL-Trans-847-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The initial process of adhering metal parts and welding them are discussed. On the basis of metallurgical and physical measurements, a general theory of pressure welding phenomena in engineering was developed. Main emphasis is placed on the elementary processes which result in bonding. Author

N72-20441 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF THE OPTIMUM COUNTERBALANCE ARM IN LEVER BALANCING SYSTEMS
G. B. Trushevich, I. L. Baklushin, and V. N. Shirokov [1971] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 10, 1971 p 169-170
(NLL-M-21270-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of the balancing system parameters (in this case the counterbalance arm and load) on some of the motor unit performance values was established from experiments done with tilting table equipment. An accurate formula was obtained for the optimum counterbalance arm. Author

N72-20442* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLENOID VALVE INCLUDING GUIDE FOR ARMATURE AND VALVE MEMBER Patent
Jack Evans, inventor (to NASA) Issued 4 Jan. 1972 13 p Filed 10 Apr. 1970 Supersedes N70-4002 (08 - 22, p 413?)
(NASA-Case-GSC-10607-1; US-Patent-3,632,081;
US-Patent-Appl-SN-27340; US-Patent-Class-251-129;
US-Patent-Class-251-333) Avail: US Patent Office CSCL 13K

The poppet of a valve is guided independently of an activating armature. The poppet is linked to the armature through a nonmagnetic spring biasing mechanism. The spring biasing mechanism has a plunger which is inserted into a coneshaped cavity in the poppet. The mechanism causes the poppet to make contact with a valve seat before the armature completes its stroke to reduce the impact force. In addition, the valve seat and the poppet have contour shapes which are designed to reduce stresses.
Official Gazette of the U.S. Patent Office

N72-20443* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPACT ENERGY ABSORBING SYSTEM UTILIZING FRACTURABLE MATERIAL Patent
Earl R. Collins, Jr., inventor (to NASA) Issued 25 Jan. 1972 12 p Filed 15 Sep. 1969 Supersedes N70-20740 (08 - 08, p 1451) Sponsored by NASA
(NASA-Case-NPO-10671; US-Patent-3,637,051;
US-Patent-Appl-SN-857967; US-Patent-Class-188-1B;
US-Patent-Class-188-1C; US-Patent-Class-188-268) Avail: US Patent Office CSCL 13I

A shock absorber is described which is suited for use as a protective barrier in an impact energy absorbing system. It is characterized by the utilization of a myriad of contiguous spheres arranged in multiple strata for absorbing forces developed on impact. A feature of the shock absorber is the use of a brittle material in the fabrication of the spheres, whereby payload rebound is inhibited and impact force dissipation is enhanced through a sequential fracture and collapse of successive strata of spheres. Official Gazette of the U.S. Patent Office

N72-20444* Nortronics, Palos Verdes Peninsula, Calif.
METHOD OF REMOVING INSULATED MATERIAL FROM INSULATED WIRES Patent
Frank B. Ramme, inventor (to NASA) Issued 25 Jan. 1972 14 p Filed 31 Dec. 1969 Supersedes N70-34652 (08 - 18, p 3358) Sponsored by NASA
(NASA-Case-FRC-10038; US-Patent-3,636,623;
US-Patent-Appl-SN-889554; US-Patent-Class-29-624;
US-Patent-Class-29-412; US-Patent-Class-29-426;
US-Patent-Class-29-527.2; US-Patent-Class-51-216;
US-Patent-Class-51-320; US-Patent-Class-51-323) Avail: US Patent Office CSCL 13H

A method is described for fabricating equal length insulated wires which have insulation removed from selected portions. The method includes the step of supporting the wires on each of two notched wire support structures or jigs by placing the two back to back and by winding wires about the two jigs. The wires' ends are cemented at the ends of the jigs. After the cement hardens, the jigs are separated from one another, so that each carries a number of wires, with each wire having portions exposed through notches in the jig. Each jig is placed in the stream of an abrasive material carrier. The carrier passes through the jig's notches causing the abrasive material to erode the insulation from portions of the wires exposed through the notches. After the removal of the insulation, the bare portions of the wires are treated, prior to removing the wires from the jig by cutting them to equal lengths.
Official Gazette of the U.S. Patent Office

N72-20445* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TORSIONAL DISCONNECT UNIT Patent
Donald J. Starkey and Kenneth C. Curry, inventors (to NASA) Issued 4 Jan. 1972 4 p Filed 31 Jul. 1970 Sponsored by NASA
(NASA-Case-NPO-10704; US-Patent-3,632,140;
US-Patent-Appl-SN-59895; US-Patent-Class-285-18;
US-Patent-Class-285-345; US-Patent-Class-138-178) Avail: US Patent Office CSCL 13I

A torsional disconnect unit suited for use in releasably coupling distal ends of mutually displaceable, coaxially related portions of a fluid conduit is described. It is characterized by a substantially rigid tube, wound to a configuration conforming to a uniform helix and having an end secured to one supported coupling component of a pair of concentrically mated coupling components, while its opposite end rigidly is fixed against rotation. The invention utilizes those characteristics of a helix which cause a helix to unwind, as it is elongated, in developing torque of a magnitude sufficient to overcome static friction as rotation between the components is initiated. Axial separation of the components is thus attainable, employing an axially directed force of magnitude sufficient to overcome sliding friction.
Official Gazette of the U.S. Patent Office

N72-20446* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR MAKING DIAMONDS Patent
John R. Rasquin and Marvin F. Estes, inventors (to NASA) Issued 4 Jan. 1972 12 p Filed 16 Jan. 1970 Supersedes N70-26821 (08 - 13, p 2391)
(NASA-Case-MFS-20698; US-Patent-3,632,242;
US-Patent-Appl-SN-03418; US-Patent-Class-425-77;
US-Patent-Class-264-22; US-Patent-Class-100-299;
US-Patent-Class-23-209.1) Avail: US Patent Office CSCL 13I

The apparatus includes an exponential horn tapering from a large end to a small end. A copper plate is mounted against the

large end of the horn and a magnetic hammer abuts the copper plate. An anvil having a small pocket is mounted adjacent to the small end of the horn so that the small end rests in the pocket. In operation, graphite is placed in the anvil pocket. The magnetic hammer generates a shock wave in the exponential horn and because of the horn shape, which is critical, the velocity of the shock wave is amplified and the shock wave energy concentrated so that all of the energy arrives simultaneously at the small end of the horn. This energy is transferred to the graphite in the anvil pocket and results in pressure and temperature levels that cause the graphite to be transformed, in part at least, to diamonds.
Official Gazette of the U.S. Patent Office

N72-20447 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF WELDMENT T-JOINT AND STEEL PLATE CONTROL
L. X. Nepomuceno, M. F. Barbosa, and M. T. Itami 13 Sep. 1971 10 p refs In PORTUGUESE; ENGLISH summary
(TR-7109.534) Avail: Issuing Activity

The adopted procedures, equipment and accessories used, the results of the ultrasonic inspection of T-joint weldments and steel plate control searching for delaminations, inclusions and the like are described. The results are presented with drawings indicating the position of defects, accompanied with photos of the observed echograms. Author

N72-20448*# Rocketdyne, Canoga Park, Calif. Advanced Systems and Turbomachinery Dept.
DESIGN OF INDUCERS FOR TWO-PHASE OPERATION Final Report, 12 Jan. 1971 - 12 Jan. 1972
J. A. King and H. G. Diem Jan. 1972 119 p refs
(Contract NAS8-26645)
(NASA-CR-122555; R-8832) Avail: NTIS CSCL 06K

A mathematical model and a digital computer program were developed for the design and evaluation of inducers for pumping two-phase oxygen. The mathematical model indicated that any design would have to be run at relatively low speeds to pump two-phase oxygen and that the J-2S oxygen inducer was close to optimum and should perform the task. A J-2S pump was built up and tested in two-phase oxygen at speeds indicated by the mathematical model. The pump was able to handle two-phase oxygen over a wide range of inducer incidence angles and up to a vapor content of 37 percent by volume with very little loss in head. The pump was still able to produce some head at vapor fractions approaching 60 percent. Author

N72-20449*# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
VISCOSEAL PERFORMANCE WITH RAREFIED-GAS SEALANT Final Report
Mancil W. Milligan Oct. 1971 117 p refs
(Grant NGR-43-001-023)
(NASA-CR-120911; AE-71-023-9) Avail: NTIS CSCL 11A

A fundamental study of viscoseals having a rarefied gas as the sealant has been conducted. Both experimental and analytical investigations are reported. Three different analytical models have been formulated and are described in detail. An experimental investigation has been conducted on multiple grooved two-inch diameter viscoseals over a wide range of gas densities and shaft speeds up to 30,000 rpm. Comparisons are presented between actual viscoseal performance and the theoretical predictions for both sealing coefficient and net leakage parameters as functions of the degree of gas rarefication. Recommendations are presented for the use of the analytical models. Author

N72-20450# Joint Publications Research Service, Arlington, Va.
EFFECT OF CARBON ON THE MECHANICAL PROPERTIES OF TITANIUM BETA-ALLOY WELD JOINTS
V. B. Vikhman and A. S. Mikhaylov 9 Mar. 1972 9 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 6, 1971 p 48-54
(JPRS-55393) Avail: NTIS

The limiting permissible carbon content was established for beta titanium alloys to be used for weldments. An increase in the crystallization rate of the weld bath due to intensive cooling of the opposite side of the joint by a water sho ver yields a significant increase in ductility and impact strength of the seam metal and makes it possible to increase the permissible carbon content in the welded metal. Author

N72-20451*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION, WEAR, AND LUBRICATION IN VACUUM
Donald H. Buckley Washington 1971 192 p refs
(NASA-SP-277; LC-72-174581) Avail: NTIS CSCL 11H

A review of studies and observations on the friction, wear, and lubrication behavior of materials in a vacuum environment is presented. The factors that determine and influence friction and wear are discussed. They include topographical, physical, mechanical, and the chemical nature of the surface. The effects of bulk properties such as deformation characteristics, fracture behavior, and structure are included. E.H.W.

N72-20452*# Naval Postgraduate School, Monterey, Calif.
SPIN TEST OF TURBINE ROTOR
Michael H. Vavra, James E. Hammer, and Lawrence E. Bell Feb. 1972 147 p refs
(NASA Order C-10836)
(NASA-CR-1967; NPS-57VA71061B) Avail: NTIS CSCL 14D

Experimental data are presented for the tangential and radial stresses in the disks of the 36,000 horsepower, 4000 rpm turbine for the M-1 engine oxidizer turbopump. The two-stage Curtis turbine is a special light-weight design utilizing thin conical disks with hollow sheet metal blades attached by electron-beam welding techniques. The turbine was fabricated from Inconel 718, a nickel-chromium alloy. The stresses were obtained by strain-gage measurements using a slip-ring assembly to transmit the electrical signals. Measurements were made at different rotative speeds and different thermal loads. In addition to presenting test data, the report describes test equipment, design of associated hardware, test procedures, instrumentation, and tests for the selection and calibration of strain gages.
Author

N72-20453# Council for Scientific and Industrial Research, Pretoria (South Africa).
SIEVING, CLASSIFYING, SEPARATING
Matthias Bohnet Feb. 1971 8 p refs Transl. into ENGLISH from VD (Ver. Deut. Ingr.) Z (Dusseldorf), v. 2, no. 18, 1970 p 1245-1247
(Rept-916) Avail: NTIS

Various methods of particle sieving and separating are considered, which are applicable in industry. The relationship between air pollution and economical purification processes is discussed. The operating principles of cyclone separators are reviewed. Separating efficiency of hydrocyclones, fabric filters, and electrostatic filters is also considered. K.P.D.

N72-20454# Joint Publications Research Service, Arlington, Va.
VIBRO-ACOUSTIC ACTIVITY OF MECHANISMS WITH GEAR TRANSMISSIONS
M. D. Genkin, ed. 17 Mar. 1972 95 p refs Transl. into ENGLISH from the book "Vibroakusticheskaya Aktivnost Mekhanizmov s Zubchatymi Peredachami" Moscow, Nauka Publishing House, 1971
(JPRS-55466) Avail: NTIS

The vibratory and acoustic properties of various mechanisms are discussed, in particular those of ship shafts and marine engines with turbine gear drives. Satellite loads, a multipolar vibration generator, and frequency analyzer are also considered.
K.P.D.

N72-20455*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GAS OPERATED ACTUATOR Patent Application
Alex Ambruso, inventor (to NASA) Filed 28 May 1971 18 p
(Contract NAS7-100)
(NASA-Case-NPO-11340; US-Patent-Appl-SN-147997) Avail: NTIS CSCL 13I

A gas operated actuator is described which includes an expansion chamber with an inlet and an outlet containing a membrane or film of material selectively permeable to the drive gas when the membrane is heated. The inlet membrane communicates with a high pressure source of drive gas and the outlet membrane with a low pressure environment or fluid environment reactive with the drive gas. The actuator is driven by alternately heating the inlet and outlet membranes to affect a cyclical expansion and contraction of the chamber. The actuator may contain a combined inlet-outlet and the membrane contained therein is alternately exposed to the drive gas and low pressure or reactive environment to effect the cyclical motion of the chamber. NASA

N72-20456*# McDonnell-Douglas Co., St. Louis, Mo.
VARIABLE DIRECTION FORCE COUPLER Patent Application
William H. Hespenhide, inventor (to NASA) Filed 28 Aug. 1970 8 p Sponsored by NASA
(NASA-Case-MFS-20317; US-Patent-Appl-SN-67730) Avail: NTIS CSCL 13E

A variable direction force coupler is described for transmitting a reciprocating force along a selectable curved path. The coupler consists of a flexible tube filled with rigid balls, including force transmission members at each end which are adapted to connect the coupler between an applied force and a body to receive the force. NASA

N72-20457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RE-EVALUATION OF THE STRESS-LIFE RELATION IN ROLLING-ELEMENT BEARINGS
Richard J. Parker and Erwin V. Zaretsky Washington Apr. 1972 18 p refs
(NASA-TN-D-6745; E-6768) Avail: NTIS CSCL 13I

Four groups of 12.7 millimeter diameter vacuum-degassed AISI 52100 balls were tested, each at a maximum Hertz stress in the range of 4.5 times 10 to 9th power to 6.0 times 10 to 9th power N/m2. Tests were run in the five-ball fatigue tester at a contact angle of 30 deg and a shaft speed of 10,000 rpm. The 10 percent fatigue lives at the four stress levels indicated that fatigue life is inversely proportional to maximum Hertz stress raised to the power of 12. This result agrees with a survey of the literature which suggests that a stress-life exponent of approximately 12 is typical of vacuum-processed bearing steels rather than the exponent of 9 which has been generally accepted by the bearing industry. Author

N72-20458+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF CAST STEEL BLOCKS [INSPECAO ULTRA-SONICA DE BLOCOS DE ACO FUNDIDO ESPECIAL]
L X. Nepomuceno 5 Aug. 1971 6 p In PORTUGUESE
(Rept-71-7.528) Avail: NTIS

The results of ultrasonic inspection of 46 cast steel blocks are presented. One casting was rejected due to the detection of a porous area. Pictures of the echograms showing the porous area and a perfect area are included. Transl. by F.O.S.

N72-20459*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GAS FLOW CONTROL DEVICE Patent Application
John B. Wellman, inventor (to NASA) Filed 10 Aug. 1971 11 p
(Contract NAS7-100)
(NASA-Case-NPO-11479; US-Patent-Appl-SN-170440) Avail: NTIS CSCL 13K

A gas flow control device is described which is comprised of a housing with an input port through which gas enters. At the port the subsonic gas flow is converted into supersonic flow. The housing includes a movable probe with a conical external surface which produces a shock wave when impinged upon by the supersonic gas flow. The probe has a cavity with a shape of a truncated cone, with the top of the cone serving as the cavity input. Mounted in the housing and surrounded by the probe is a mandrel with a truncated cone-shaped top, whose surface corresponds to the cavity surface. By moving the probe toward and away from the input port, the rate of gas flowing to an output port is controlled. The shock wave prevents disturbances due to changes in gas flow rate advancing upstream. NASA

N72-20460*# Whittaker Corp., Los Angeles, Calif.
REINFORCED POLYQUINOXALINE GASKET AND METHOD OF PREPARING THE SAME Patent Application
Richard VanAuken, inventor (to NASA) Filed 30 Dec. 1971 11 p
(Contract NAS8-25361)
(NASA-Case-MFS-21364; US-Patent-Appl-SN-21364) Avail: NTIS CSCL 13I

A gasket or seal, resistant to ionizing radiation and liquid hydrogen temperatures, is made up of a laminated polyquinoxaline resin-fiberglass cloth body portion and a molded polyquinoxaline encapsulating film. The laminated body is prepared by stacking thin sheets of the resin alternately with fiberglass cloth and heating the assembly under pressure, with temperature, pressure, and resin film thickness controlled so that only partial impregnation of the fiberglass cloth is produced. The encapsulating resin film is preheated at about 300 F and applied to the laminate body by molding at a temperature of about 625 F, after which the molded gasket is deflashed and postcured by heating at 675 to 700 F. NASA

N72-20461*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PEEN PLATING Patent Application
Carl L. Haehner and Alfred J. Babecki, inventors (to NASA) Filed 6 Dec. 1971 16 p
(NASA-Case-GSC-11163-1; US-Patent-Appl-SN-205047) Avail: NTIS CSCL 13H

A process for metal plating is described which comprises spraying a mixture of metallic powder and small peening particles at high velocity against a surface. The velocity is sufficient to impact and bond the metallic powder onto the surface. In the case of metal surfaces, the process has the advantage of providing mechanical working (hardening) of the surface, simultaneously with metal plating. Author

N72-20462*# North American Rockwell Corp., Downey, Calif.
BIDIRECTIONAL FLOW CONTROL DEVICE Patent Application
Robert F. Sutton, inventor (to NASA) Filed 18 Nov. 1971 9 p
(Contract NAS8-19)
(NASA-Case-MFS-18737; US-Patent-Appl-SN-199965) Avail: NTIS CSCL 13K

A bidirectional fluid flow control device is described, which has a longitudinally movable plate penetrrated by a number of orifices. The plate is disposed in a chamber transverse to the fluid stream in a manner such that fluid pressure causes the plate to be seated against the downstream chamber wall with one or more orifices open to fluid flow. Reversal of fluid flow disengages the plate from its initial seating and causes it to be seated against the opposite wall, exposing a different set of orifices. Seating means on the chamber walls are spaced such that more orifices are open to fluid flow in one direction than in the other. Author

N72-20463*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TWO SPEED DRIVE SYSTEM Patent Application
John L. Burch, inventor (to NASA) Filed 31 Dec. 1970 14 p
(NASA-Case-MFS-20645; US-Patent-Appl-SN-103091) Avail: NTIS CSCL 13I

A two-speed drive system is described for driving an independently driven vehicle wheel comprising a relatively large wheel sprocket attached to the vehicle wheel. A drive belt passes around the large wheel sprocket and one of a pair of smaller, selectively interchangeable, motor-driven wheels. The two smaller wheels are of the same diameter, but rotate at different speeds, and are mounted on a plate that may be temporarily released through a latching pawl for rotation of 180 deg, so that the two wheels change places. No external force is required to rotate the plate when released, since one of the smaller wheels turning in contact with the drive belt causes the plate to rotate, rather than the drive belt and large wheel sprocket. When the drive belt is engaging both of the smaller wheels simultaneously during the shifting phase, the normally slower turning wheel turns faster through a ratchet mechanism.
Author

N72-20464*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW MASS ROLLING ELEMENTS FOR BEARINGS Patent Application
Richard J. Parker, inventor (to NASA) Filed 24 Nov. 1971 8 p
(NASA-Case-LEW-11087-1; US-Patent-Appl-SN-201904) Avail: NTIS CSCL 13I

The invention is particularly directed to rolling elements having lightweight cores that are plated. A rolling element bearing assembly comprises an outer race spaced from an inner race. Rolling elements in the form of balls are spaced between the races by a separator. The rolling element is made up of either a hollow core or a solid lightweight core. Both of these cores are covered by a coating of iron. The plated cores are then heat treated and ground to required tolerances. The low mass rolling elements have a high fatigue strength and a high resistance to flexure fatigue. By properly selecting the materials for the rolling elements the fatigue strength may be as good as or better than solid rolling elements of conventional materials.
NASA

N72-20465*# Denver Research Inst., Colo.
METAL SHEARING ENERGY ABSORBER Patent Application
Richard J. Fay and Edward P. Wittrock, inventors (to NASA) Filed 28 Dec. 1971 10 p
(Grant NGL-06-004-078)
(NASA-Case-HQN-10638; US-Patent-Appl-SN-212977) Avail: NTIS CSCL 13I

A metal shearing energy absorber is described, which comprises a flat thin strip of metal which is pulled through a slot in a cutter member of a metal, harder than the metal of the strip. The slot's length, in the direction perpendicular to the pull direction, is less than the strip's width so that as the strip is pulled through the slot, its edges are sheared off, thereby absorbing some of the pulling energy. In one version, the cutter member is a flat plate of steel, while in another the cutter member is U-shaped, with the slot at its base.
NASA

N72-20466# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE VIBRATIONS OF GYROMOTORS WITH AERODYNAMIC SPHERICAL SUPPORTS
Baranov, I. A., S. G. Kan, E. P. Sevodin, and I. V. Iakovlev 1971 3 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad v. 14, no. 11, 1971 p 86-88
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results are given for comparative investigations of the vibration parameters for gyromotors with aerodynamic and ball bearing supports.
Author

N72-20467*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
FLOATING BAFFLE TO IMPROVE EFFICIENCY OF LIQUID TRANSFER FROM TANKS Patent Application
Frank S. Howard, inventor (to NASA) Filed 16 Sep. 1971 11 p
(NASA-Case-KSC-10639; US-Patent-Appl-SN-181023) Avail: NTIS CSCL 13I

A floating baffle is described which rides up and down on a vertical shaft over a drain in a tank as the liquid level within the tank varies. When the baffle is in the raised position, the liquid is allowed to flow out of the drain at an unrestricted rate. When the baffle is lowered, it prevents pull-through of air or gas that is above the liquid, which would interfere and reduce the flow of liquid from the tank.
NASA

N72-20468*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ZERO GRAVITY LIQUID TRANSFER SCREEN Patent Application
Frank S. Howard, inventor (to NASA) Filed 16 Sep. 1971 13 p
(NASA-Case-KSC-10626; US-Patent-Appl-SN-180963) Avail: NTIS CSCL 13I

A liquid transfer device is described for use in a zero gravity environment, such as outer space, for transferring liquid from one container to another. The device includes a spiral-shaped screen-type member which is carried in the container for collecting randomly dispersed liquid and transferring it to an exit port.
NASA

N72-20469# Bendix Corp., Kansas City, Mo.
MIXING HEAD FOR URETHANE FOAM METERING AND MIXING MACHINES
R. A. Daniel Sep. 1971 17 p
(Contract AT(29-1)-613)
(BDX-613-537) Avail: NTIS

The development is reported of a mixing head design which incorporates individual valve and activator assemblies for each material component system, with independent pneumatic controls for each component system. The mixing head was designed to have a three-component capability so that operation is possible in any of three modes: (1) one three-component system; (2) one two-component system with very high thru-put using two valves for one component; and (3) any number of two-component systems, limited only by foam machine capability. The valve assembly was designed to allow material recirculation and to accommodate standard internal thermocouple probes to measure material temperature.
Author

N72-20470# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THE TITANIUM EVAPORATION PUMP, ITS APPLICATION TO NUCLEAR FUSION EXPERIMENTS AND SPACE SIMULATION
F. Prevot and Z. Sledziewski 1971 32 p refs Presented at 5th Intern. Vacuum Congr., Boston, 11-15 Oct. 1971
(CEA-CONF-1858; Conf-711005-4) Avail: AEC Depository Libraries

The performance of low-temperature Ti evaporation pumps is briefly discussed (getter capacity of about 10 to the 16th power mol/cm2, limiting vacuum (10 to the minus 10th power torr). An apparatus intended for a magnetic mirror configuration and space simulation chambers equipped with Ti evaporation pumps are described.
NSA

N72-20471# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
DEVELOPMENT OF HIGH TEMPERATURE ROLLING BEARINGS FOR OPERATION IN LIQUID SODIUM Quarterly Progress Report, 1 Apr. - 30 Jun. 1971
W. E. Jamison 30 Jun. 1971 16 p refs

(Contract AT(30-1)-4117)
(NYO-4117-5; QPR-4) Avail: NTIS
Work devoted to development of equipment and methods for use in investigation of rolling bearing performance in liquid sodium at 1200 F is summarized. Materials to be tested are NM100 tool steel and Udimet 700. NSA

N72-20472# Grand Junction Office (AEC), Colo.
STATISTICAL DATA OF THE URANIUM INDUSTRY
1 Jan. 1971 54 p
(TID-25814) Avail: NTIS
A compilation of historical facts and figures and current status as of Jan. 1, 1971 of the U.S. uranium industry is presented. Information is included on ore and concentrate purchases, uranium resources, distribution of deposits, drilling statistics, land acquisition for U mining and exploration, employment, domestic U3O8 sales and projected requirements, and processing mills. NSA

N72-20473# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE RESISTANCE OF MACHINE PARTS TO SEIZING AND WEAR
Jiri Nainar 19 Oct. 1971 19 p Transl. into ENGLISH from the book "Materialovy Sbornik 1969. Materialy Odolne Proti Opotrebeni a Metody Jeho Zkouseni" Prague, 1969 p 81-92
(AF Proj. 7343)
(AD-734899; FTD-HC-23-961-71) Avail: NTIS CSCL 11/8
A review is given of the results obtained in Czechoslovakia with the use of sulfurization of friction surfaces, and of the MoS (subscript 2) lubricant. GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-20474*# Radiation, Inc., Ann Arbor, Mich. Electro-Optics Center.
OPTICAL READ/WRITE MEMORY SYSTEM COMPONENTS
Final Report, 12 Jan. 1971 - 29 Feb. 1972
A. Kozma 29 Feb. 1972 248 p refs
(Contract NAS8-26672)
(NASA-CR-122559; Rept-8105-F-1) Avail: NTIS CSCL 09D
The optical components of a breadboard holographic read/write memory system have been fabricated and the parameters specified of the major system components: (1) a laser system; (2) an x-y beam deflector; (3) a block data composer; (4) the read/write memory material; (5) an output detector array; and (6) the electronics to drive, synchronize, and control all system components. The objectives of the investigation were divided into three concurrent phases: (1) to supply and fabricate the major components according to the previously established specifications; (2) to prepare computer programs to simulate the entire holographic memory system so that a designer can balance the requirements on the various components; and (3) to conduct a development program to optimize the combined recording and reconstruction process of the high density holographic memory system. Author

N72-20475# Lockheed Missiles and Space Co., Palo Alto, Calif.
LASER DETECTION OF DEFECTS IN THE MODEL OF A HEAT-LIBERATING ELEMENT
V. V. Berezovskii, Iu. A. Bykovskii, V. A. Gridin, L. S. Kokorev, and Iu. N. Shelagin [1971] 7 p refs Transl. into ENGLISH from Vopr. Teplofiz. Iadernykh Reaktorov (USSR), no. 3, 1971 p 93-100
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A focused laser beam operating with 6W power in the continuous mode was used to detect defects in the model of a heat-liberating shell with a scaling cavity under the shell. The equations for the temperature fields are developed for the scaling area that satisfy the boundary conditions. The scheme for checking the defect is described as follows: The laser beam is displaced along the shell together with the temperature sensor which is separated at a constant distance from the laser. The temperature rises in the scaling domain. It is concluded that the use of CO2 + N2 + He laser operating in the Q modulated mode will result in further perfection of nondestructive testing. F.O.S.

N72-20476*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALIGNMENT APPARATUS USING A LASER HAVING A GRAVITATIONALLY SENSITIVE CAVITY REFLECTOR
Patent Application
Kenneth W. Billman and Eugene T. Leonard, inventors (to NASA) (DOT) Filed 30 Jul. 1971 18 p
(NASA-Case-ARC-10444-1; US-Patent-Appl-SN-167719) Avail: NTIS CSCL 20E
A device is described for determining a true gravitational vertical. It includes a vertically disposed laser with gravitationally sensitive lower regeneration reflector which enables an output beam to be developed only when the optical axis of the laser is disposed normal to the gravitationally sensitive reflective surface. In an alternate configuration, the device is combined with a servo system to provide a gravitationally stabilized horizontal platform. NASA

N72-20477*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER PROPULSION
Frank E. Rom and Henry A. Putre Washington Apr. 1972 20 p refs
(NASA-TM-X-2510; E-6746) Avail: NTIS CSCL 21C
The use of an earth-based high-power laser beam to provide energy for earth-launched rocket vehicle is investigated. The laser beam energy is absorbed in an opaque propellant gas and is converted to high-specific-impulse thrust by expanding the heated propellant to space by means of a nozzle. This laser propulsion scheme can produce specific impulses of several thousand seconds. Payload to gross-weight fractions about an order of magnitude higher than those for conventional chemical earth-launched vehicles appear possible. There is a potential for a significant reduction in cost per payload mass in earth orbit. Author

N72-20478*# Translation Consultants, Ltd., Arlington, Va.
USE OF A LASER FOR ATOMIC ABSORPTION ANALYSIS
E. P. Krivchikova and V. S. Demin Washington NASA Apr. 1972 9 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 14, no. 4, Apr. 1971 p 592-596
(Contract NASw-2038)
(NASA-TT-F-14132) Avail: NTIS CSCL 20E
The localization of a laser beam in a small area of a solid steel sample (steel with high Cr content) is described. A continuous spectrum with absorption lines (due to absorption of atoms mainly) is emitted and registered by a spectrograph. The lines Ni I 2320.0, Cr I 3015.5, Mn I 2794.8, and Si I 2516.1 A were used to determine 0.1 to 1% Ni, Mn, and Si and 9 to 17% Cr in steel. The calibration curves are linear; the mean relative error is 3%. Author

N72-20479# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE DEVELOPMENT OF AN AIRBORNE REMOTE LASER FLUOROSENSOR FOR USE IN OIL POLLUTION DETECTION AND HYDROLOGIC STUDIES
R. M. Measures and M. Bristow Dec. 1971 36 p refs
Sponsored by Dept. of Energy, Mines, and Resources

(UTIAS-175) Avail: NTIS

The first phase of a development program devoted to the exploitation of laser induced fluorescence for environmental sensing has been completed. A prototype laser fluorosensor has been constructed and used to evaluate, in the laboratory, the feasibility of this concept and to explore the potential range of applications. Special attention has been given to assessing the ability of a laser fluorosensor to map the extent of an oil slick, locate the source of lignin sulphonate pollution and monitor the dispersal of a tracer dye for hydrologic uses. The preliminary results are very encouraging and lead to prediction that a laser fluorosensor could be used for environmental sensing from an aircraft flying at between 1000 and 2000 ft on a 24-hour basis.
Author

N72-20480# Aix-Marseilles Univ. (France). Faculte des Sciences.
ELECTROMAGNETIC RADIATION COHERENCE ROLE IN GAS PHOTOIONIZATION AND RADIATION SCATTERING IN FOCUSING A LASER BEAM Ph.D. Thesis
Jean Millet 1970 103 p refs In FRENCH
(FRNC-TH-103) Avail: AEC Depository Libraries

Two phenomena associated with the laser-beam breakdown of gases were theoretically studied: multiphoton absorption and laser scattering. A multiphoton effect theory, constructed from Feynman diagrams, describes the effect of the statistical properties of the radiation on this phenomenon. Pure coherent and incoherent electromagnetic fields were compared. The Thomson scattering cross section was calculated; the scattered radiation statistics and their connection with density fluctuations were studied. The main characteristics of the plasma can be determined experimentally by studying the frequency spectrum of the scattered light. Experiments for measuring the transition probability in the multiphoton effect with a cesium jet and experiments for studying the laser radiation scattering spectrum by an afterglow plasma are being undertaken.
NSA

N72-20481# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
PREPARATION OF LEAD SELENIUM AND TIN SELENIUM ALLOY MONOCRYSTALS Final Report [PREPARATION DE MONOCRISTAUX D'ALLIAGE PBSE-SNSERAPPORT FINAL]
M. Moulin. 9 Jan. 1970 41 p In FRENCH Sponsored by Delegation Gen. a la Rech. Sci. et Tech.
Avail: NTIS

A method for the preparation of monocrystals of PbSe/SnSe to be used in infrared detectors and lasers is described. It includes the chemical synthesis of solid solutions, a crystal growth method, tests of vapor phase transport, and a study of heat treatment of annealed single crystals, as well as calibration of electric properties.
ESRO

N72-20482# Rome Univ. (Italy). Inst. of Physics.
INFRARED GENERATION BY COHERENT EXCITATION OF POLARITONS
F. DeMartini 14 Apr. 1971 83 p refs
(Nota-Interna-312) Avail: NTIS

An extended theoretical account of the polariton propagation in a cuvic crystal is given starting from a general transient theory of the nonlinear mixing process in the Restrahl band. An experiment is described in which two optical fields are interacting in a III-V semiconducting gallium phosphide crystal where a coherent polariton is created. The experimental determination of the spatial evolution of the polariton field in the quasi-collinear kinematical configuration and the angular distribution of the emitted infrared field lead to precise measurements of the refraction index of the crystal and absorption coefficient. Furthermore the frequency dependence of the emitted infrared intensity allows the study of the dispersion of the nonlinear optical susceptibility of the crystal near the Restrahl Band.
ESRO

N72-20483# Naval Ordnance Lab., White Oak, Md.
CHEMICAL GENERATION OF HIGH TEMPERATURE, HIGH PRESSURE GAS FOR LASER APPLICATIONS
Barry G. Pallay and Carl T. Zovko 5 Nov. 1971 50 p refs
(ORD Proj. 551/020/128-1/U-1754)
(AD-735107; NOLTR-71-131) Avail: NTIS CSCL 20/5

The report discusses experimental and theoretical work done on the use of propellant-like compositions as generators for supplying gas mixtures for gas dynamic laser applications. The gaseous mixtures desired consist of high temperature, high pressure nitrogen, carbon dioxide and water vapor. The propellant-like compositions rely on sodium azide (NaN3) and an oxidizer as the principal source of gas. The mixtures considered to be most promising consist of sodium azide, sulfur, carbon, sodium nitrate and additional compounds to provide water vapor and improve the composition of the gas. This gas generator system shows considerable promise for gas dynamic laser applications by virtue of its simplicity, compactness, low cost and extremely short start up time. The major problem areas with the solid propellant mixture are achieving optimum quantity and composition of reaction products and improving propellant physical properties.
Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-20484 National Lending Library for Science and Technology, Boston Spa (England).
A NEW THEORY OF WORK-HARDENING OF METALS
J. Gulyas 28 Dec. 1971 8 p refs Transl. into ENGLISH from Nehezipari Muszaki Egyet. Kozlemen. (Miskolc), v. 31, 1970 p365-371 In GERMAN and ENGLISH
(NLL-Trans-746-1094-(9022.401); NLL-LTI-734-7613) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The changes that occur in single crystals during work hardening were studied and then extended to polycrystalline metals. Work hardening curves are analyzed and, based on Seeger's theory and stacking fault energy, the equation for the parabolic section of the curve is developed.
F.O.S.

N72-20485 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATIONSHIP OF THE MODULUS OF ELASTICITY AND INTERNAL FRICTION OF IRON TO TEMPERATURE
Yu. D. Chizhenko, A. Ya. Khrapov, and L. V. Shchekurakaya [1971] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 10, 1971 p 110-122
(NLL-M-21263-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The elastic properties of iron at high temperatures are investigated. The degree to which iron is eutetic was found to vary from 0.83 to 1.16, and it was determined that iron structure changed from pearlitic to pearlitic-ferritic, with inclusions of graphite from spheroidal to corse platelet form. It was established that, when iron containing spheroidal or compact graphite is heated and then cooled, as it cools its modulus of elasticity decreases alightly, that iron with graphite between the dedrites and oriented loses its elastic properties to a great extent, but that the modulus of elasticity of low grade irons containing graphite in the form of coarse platelets increases. As the degree of eutecticity increases, the heat resistance of the alloy increases. The manner in which the elastic and damping properties of the iron from any heat alter depends not on the thickness of casting walls, but on the position occupied by the alloy on the equilibrium diagram.
Author

N72-20486 National Lending Library for Science and Technology, Boston Spa (England).
INTERMEDIATE TRANSFORMATION OF AUSTENITE IN KhVG-STEEL IN AN ULTRASONIC FIELD
E. G. Aizentson and I. K. Utrobina [1971] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 10, 1971 p 115-118
(NLL-M-21262-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Intermediate transformation of austenite in reference and ultrasonically bombarded specimens of KhVG-steel was studied by measurement of magnetic permeability and electrical resistivity, and X-ray determination of the quantity ratios of the structural components. Ultrasonic bombardment in the upper part of the intermediate range (450 C) had an austenite-stabilizing effect which diminished during ultrasonic treatment for long periods at high amplitudes and also led to a high degree of transformation of undecomposed austenite to martensite in subsequent cooling. Ultrasonic treatment in the lower part of the intermediate range (300 C) resulted in austenite decomposition, the amount of decomposition decreasing with increasing amplitude of the ultrasonic vibrations. The changes in the intermediate transformation rate in ultrasonically treated specimens result from the influence of ultrasonic heating, microplastic strains, and the development of a defect structure. Author

N72-20487*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
INFLUENCE OF RESTRAINT AND THERMAL EXPOSURE ON WELDS IN T-111 AND ASTAR-811C Final Report
R. E. Gold and G. G. Lessmann Mar. 1971 126 p refs
(Contract NAS3-11827)
(NASA-CR-72858; WANL-PR(VVV)-001) Avail: NTIS CSCL 11F

The notched-tensile, tensile, and bend properties of GTA welds in T-111 and ASTAR-811C sheet were determined following a wide range of thermal exposures in order to define changes in ductility and mechanical property behavior due to weld aging response. No notch sensitivity or unusual tensile response was noted for any of the conditions evaluated. An aging response was noted for the bend ductile-brittle transition temperature determinations on both T-111 and ASTAR-811C welds. A tentative explanation for the observed response of each alloy is presented. In addition, the interrelationship of mechanical and chemical factors leading to underbead cracking in T-111 was investigated. The problem was shown to be amenable primarily to chemical solutions, such as alloy compositional changes. This was demonstrated by the improved performance of ASTAR-811C over T-111 in plate weld studies. Only modest success was achieved using procedural techniques as a means of eliminating underbead cracking. Author

N72-20488# Technische Univ., Berlin (West Germany). Fachbereich Werkstoffwissenschaften.
STUDIES ON THE CRYSTALLIZATION PROCESSES IN ALUMINUM-SILICON ALLOYS BY HIGH TEMPERATURE MICROSCOPE (WITH SUPPLEMENTARY OBSERVATIONS ON EUTECTIC SILVER-COPPER, SILVER-SILICON, AND GOLD-SILICON ALLOYS) Ph.D. Thesis [UNTERSUCHUNGEN DES KRISTALLISATIONSABLAUFS VON ALUMINIUM-SILIZIUM-LEGIERUNGEN IM HOCHTEMPERATUR-MIKROSKOP (MIT ERGAENZENDEN BEOBACHTUNGEN AN EUTEKTISCHEN SILBER-KUPFER-, SILBER-SILIZIUM- UND GOLD-SILIZIUM-LEGIERUNGEN)]
Stefan Justi 2 Aug. 1971 76 p refs In GERMAN
Avail: NTIS

It is shown that primary silicon crystals grow polyhedral in super-eutectic AlSi melts and that phosphorus additives to the melt confirm the strong seeding capacity. Primary silicon exhibits strong dendritic seeding effects in eutectic silicon phases of various silicon alloys, whereas primary aluminum does not possess this capacity. Sodium addition also produces a dendritic silicon network growth in the interior of the sample that is attributed to the slower silicon diffusion velocity during cooling.
Transl. by G.G.

N72-20489# Technische Hochschule Munchen (West Germany).
LIGAND-METAL EXCHANGE EFFECTS IN PARAMAGNETIC TRANSITION METAL COMPLEXES Ph.D. Thesis [LIGAND-METALL-WECHSELWIRKUNGEN IN PARAMAGNETISCHEN UEBERGANGSMETALLKOMPLEXEN]
Hans-Gernot Biedermann 1971 88 p refs In GERMAN
Avail: NTIS

Spectroscopic analysis of the electron delocalization mechanism of a large number of paramagnetic transition metal complexes was conducted. Various substances were treated as novel, two-toothed ligands in a pseudo-octahedral complex of cobalt 2 and nickel 2. The proton resonance spectroscopic research of these compounds indicated that the phenolic group of the complex ligands at times had small influence on the delocalization mechanisms and the magnitude of the electron delocalization. It is shown that the empirical determination of the characteristics of paramagnetic complex molecules can be determined by KMR-spectroscopy, as well as the original electron state, the stability, and the bonds of the reactions.
Transl. by P.N.F.

N72-20490# Joint Publications Research Service, Arlington, Va.
CLASSIFICATION OF BINARY EUTECTICS
V. A. Filonenko 16 Mar. 1972 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metal. (USSR), no. 6, 1971 p 154-160
(JPRS-55452) Avail: NTIS

Binary solid eutectics are considered as solid structures of two-phase compositions, one-phase solutions, metastable intermetallides, or amorphous formations. The structure of the phase boundary is discussed along with the cooling conditions, and eutectics are classified in three groupes according to the structure. It is concluded that the method of directed crystallization of eutectics can be to produce regular compositions from irregular eutectics. F.O.S.

N72-20491# Advisory Group for Aerospace Research and Development, Paris (France).
NATO NATIONAL REPORTS ON HIGH TEMPERATURE CORROSION OF AEROSPACE ALLOYS
R. I. Jaffee, ed. (Battelle Mem. Inst., Columbus, Ohio) Feb. 1972 36 p
(AGARD-R-591; GARD-591) Avail: NTIS

A presentation, in a series of brief statements, on much of the research and development work in progress and some that is planned, in nine (9) NATO countries, on high temperature corrosion of aerospace alloys is given. Author

N72-20492*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC FURNACE OXIDATION OF CLAD WI-52 SYSTEMS AT 1040 C AND 1090 C
Michael A. Gedwill Washington Apr. 1972 31 p
(NASA-TN-D-6730; E-6399) Avail: NTIS CSCL 11F

Cyclic furnace oxidation studies were conducted on the cobalt alloy WI-52 clad with Ni-30Cr, Fe-25Cr-4A1, and Ni-20Cr-4A1 foils (0.051 to 0.254 mm thick). Tests as long as 400 hours using 1- and 20-hour cycles showed that the Ni-Cr- and Fe-Cr-A1 claddings were about equally protective at both temperatures. The protective ability of these alloys was influenced by exposure temperature and cladding thickness. At both temperatures, they protected WI-52 about as well as, or better than, a widely used commercial aluminide coating. The Ni-Cr-Al claddings did not protect WI-52 nearly as well. Interdiffusion generally influenced the oxidation behavior of all clad WI-52 systems. Author

N72-20493*# Translation Consultants, Ltd., Arlington, Va.
FRETTING CORROSION
N. Golego, A. Alyabyev, and V. Shevelya Washington NASA Apr. 1972 9 p Transl. into ENGLISH from Grazhdanskaya Aviatsiya (Moscow), no. 1, Jan. 1971 p 18-19

(Contract NASw-2038)
(NASA-TT-F-13953) Avail: NTIS CSCL 11F

The results obtained in investigations of the fretting corrosion mechanism are discussed. Electron microscopy, X-ray structure, microstructure, and inductive analyses were used to analyze the processes involved in the fretting corrosion phenomenon. The results indicate that there are three stages involved in the destructive process. The first stage is that of seizing of the metal surfaces, the shearing away of the seizure nodes, and the formation of microscopic irregularities. The second stage is characterized by oxidation of the highly dispersed layers, which are highly active chemically, and by their abrasive wearing. The third stage is connected with wear of the zones of influence, disintegrated by the fatigue-oxidation processes. D.L.G.

N72-20494*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ZM-21 MAGNESIUM ALLOY CORROSION PROPERTIES AND CRYOGENIC TO ELEVATED TEMPERATURE MECHANICAL PROPERTIES

J. W. Montana and E. E. Nelson 14 Mar. 1972 27 p
(NASA-TM-X-64645) Avail: NTIS CSCL 11F

The mechanical properties of bare ZM-21 magnesium alloy flat tensile specimens were determined for test temperatures of +400 F, +300 F, +200 F, +80 F, 0 F, -100 F, -200 F, and -320 F. The ultimate tensile and yield strengths of the material increased with decreasing temperature with a corresponding reduction in elongation values. Stress corrosion tests performed under: (1) MSFC atmospheric conditions; (2) 95% relative humidity; and (3) submerged in 100 ppm chloride solution for 8 weeks indicated that the alloy is not susceptible to stress corrosion. The corrosion tests indicated that the material is susceptible to attack by crevice corrosion in high humidity and chemical type attack by chloride solution. Atmospheric conditions at MSFC did not produce any adverse effects on the material, probably due to the rapid formation of a protective oxide coating. In both the mechanical properties and the stress corrosion evaluations the test specimens which were cut transverse to the rolling direction had superior properties when compared to the longitudinal properties. Author

N72-20495# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

KINETICS OF THE HYDRIDATION IN TERPHENYL, OUTSIDE THE BATTERY, OF EXPLOSIVE WELDED Zr-2.5 PERCENT Nb/CARBON STEEL JOINTS

F. Coen, B. Henry, and B. Huber 18 Feb. 1971 36 p refs In FRENCH
(EUR-4677) Avail: AEC Depository Libraries; EUR FF 5.60

The hydriding rate in terphenyl of explosive welded Zr-2.5% Nb/carbon steel joints, designed for pressure tubes of heavywater moderated reactors, was evaluated experimentally. Both longitudinal samples cut in the joints and whole joints were exposed to terphenyl in an autoclave at 360 and 400 C, with different exposure times. The total quantity and the distribution of hydrogen introduced in the zirconium through the steel part of the joints were measured. A theoretical analysis of the phenomenon is presented in order to extrapolate the results to the real case of the long zirconium tube, in the temperature range of practical interest. The results indicate that the hydrogen saturation of the long zirconium tube near the zirconium-steel weld, would be reached in 300 hr at 400 C, 17,000 hr at 360 C, and 400,000 hr at 300 C. Author (NSA)

N72-20496# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.

DIFFUSIONLESS PHASE TRANSITIONS IN NEAR-EQUIATOMIC TiNi

Gary Dale Sandrock 31 Jul. 1971 197 p refs
(Contract AT(11-1)-588)
(COO-588-22) Avail: NTIS

The intermetallic compound TiNi undergoes a martensitic phase transformation on cooling through the vicinity of room temperature. The events preceeding and including this transformation were studied by X-ray diffraction, transmission and scanning electron microscopy, hot and cold stage light microscopy, and electrical resistivity techniques. Two overall temperature realms can be discerned: (1) a premartensitic premonitory range, where unusual diffraction and resistivity effects can be observed in the absence of macroscopic surface relief, and (2) a martensitic range, which shows different diffraction and resistivity behavior, and results in the surface relief characteristic of martensite transformations. Partial cycling through the martensitic range lowers the martensite start temperature, prolonging and accentuating the premartensitic behavior. Author

N72-20497# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.

TRANSFORMATION-CHARACTERISTICS OF ZIRCONIUM-NIOBIUM AND OTHER ALLOYS Final Report

R. F Hehemann 1 Nov. 1971 13 p refs
(Contract AT(11-1)-588)
(COO-588-25) Avail: NTIS

The principal results of an investigation on transformations in zirconium and other alloys conducted during the period from November 1957 to October 1971 are summarized. The principal focus of the work has been concerned with the characterization and evaluation of some of the more important metastable states encountered in the bcc transition metals. The zirconium-niobium system was chosen not only because this system is ideally suited for this purpose but also because of its interest in nuclear reactor and superconductor applications. For generalization of some of the principal results, the equiatomic intermediate phase in the TiNi system was also examined. The latter alloy is of special interest for a variety of applications because of its well known shape-memory behavior. Author (NSA)

N72-20498# Metallwerke Otto Fuchs, Heinerzhagen (West Germany).

PRESENT DEVELOPMENT IN THE FIELD OF HIGH STRENGTH ALUMIUNUM/ZINC/MAGNESIUM/COPPER ALLOYS CONTAINING ZIRCONIUM [DIE GEGENWAERTIGEN ENTWICKLUNGSARBEITEN AUF DEM GEBIET DER HOCHFESTEN ZIRKONHALTIGEN AL ZNMGCU-LEGIERUNGEN]

G. Fischer, F. W. Lynker, and M. Markworth Cologne DGLR 1971 15 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A comparison was made between the addition of zirconium and chromium to Al-Zn-Mg-Cu high strength alloys. Attention was paid to the quenching sensitivity, machining properties, stress corrosion resistance and other mechanical properties. The exchange of chromium for zirconium is found to lessen the quenching sensitivity, so that the mechanical properties Al-Zn-Mg-Cu alloy bars allow up to 150 mm heat treated diameter. Stress corrosion resistance for the alloy is an acceptable compromise. ESRO

N72-20499# Fraunhofer Institut, Freiburg (West Germany).

THE INFLUENCE OF A MAGNETIC FIELD ON HIGH PRESSURE PHASE DIAGRAMS OF ARMCO IRON AND STANDARDIZED STRUCTURAL STEEL [DER EINFLUSS EINES MAGNETFELDES AUF DIE HOCHDRUCKPASENDIAGRAMME VON ARMCO-EISEN UND NORMIERTEM BAUSTAHL]

D. R. Curran and H. Hornemann Bonn Bundeswehramt 1971 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVG-FBWT-71-29) Avail: NTIS; Bundeswehramt Bonn: 25 DM

Tests with shock waves are described. The influence of a magnetic field of 2000 A turns/m upon the high-pressure phase diagrams of Armco iron and unalloyed structural steel was measured. In both materials the magnetization caused a reduction

of the transitional pressure from the alpha to the gamma phase and from the alpha to the epsilon phase of approximately 10 kbar. Author (ESRO)

N72-20500# Naval Research Lab., Washington, D.C.
ENGINEERING SIGNIFICANCE OF STATISTICAL AND TEMPERATURE INDUCED FRACTURE MECHANICS TOUGHNESS VARIATIONS ON FRACTURE-SAFE ASSURANCE Interim Report
F. J. Loss 2 Dec. 1971 23 p refs
(Contract AT(49-5)-2110; RR Proj. 007-11-41-5409)
(AD-734665; NRL-7353) Avail: NTIS CSCL 11/6

An appraisal is made of linear elastic fracture mechanics (LEFM) as a method for fracture-safe assurance of carbon and low-alloy steels. The theoretical advantage of an exact flaw size-stress level relationship offered by LEFM is contrasted with the limitations posed in actual application. These limitations relate to statistical variations K(Ic) and K(Id) data. The variations considered here are (a) data scatter at a given temperature, and (b)toughness variations between different heats of a given alloy. In an engineering context, LEFM is considered applicable only in the temperature region representing the initial development of the brittle-ductile transition that characterizes low-alloy steels. In this region statistical variations in the data can result in critical flaw sizes that are significantly smaller than the values calculated on the basis of limited experimental data. Author (GRA)

N72-20501# Naval Research Lab., Washington, D.C.
EVALUATION OF INHIBITORS IN THE CORROSION OF AISI 304 STAINLESS STEEL BY FC-196 AQUEOUS FILM FORMING FOAM CONCENTRATE
Clarence M. Shepherd and Robert L. Jones 7 Dec. 1971 9 p refs
(NRL Proj. S-4343-12081)
(AD-734666; NRL-7360) Avail: NTIS CSCL 11/6

An accelerated corrosion test employing rubber band-gridled coupons, the 'NRL Rubber Band Test', was used to determine corrosion characteristics of 304 stainless steel in FC-196, a 3-M Company mixture of fluorine-substituted organic compounds used to generate aqueous film-forming foam (AFFF) for fire control on Navy ships. Author (GRA)

N72-20502# Army Foreign Science and Technology Center, Charlottesville, Va.
ABSORPTION OF ENERGY BY METALS IN PLASTIC COMPRESSION AS A FUNCTION OF MELTING POINT
A. A. Federov 1971 19 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Moscow), v. 11, no. 11, 1941 p 999
(AD-735019; FSTC-HT-23-778-71) Avail: NTIS CSCL 11/6

Energy absorption by metals under static compression is shown to vary directly with fusion temperature. This is explained by the greater occurance of relaxation in fusible metals. GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-20503 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF PORE SIZE OF FILTER MATERIALS FROM NON-SPHERICAL POWDERS
S. M. Solonin, N. P. Sleptsova, and L. I. Chernyshev 19 Nov. 1971 14 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), no 1, 1971 p 38-44 In ENGLISH and RUSSIAN
(NLL-TRANS-746-1025-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The pore sizes of porous materials composed of nonspherical powders were determined using various methods, and they were compared with fineness obtained by filtering. It is shown that, in general, the purification fineness of powder filters probably depends on the size of the specific material surface. Author

N72-20504 Liege Univ. (Belgium). Lab. d'Essais des Constructions du Genie Civil et d'Hydraulique Fluviale.
STUDY FOR POLYMERIZATION AND CURING OF POLYESTER AND EPOXY RESINS BY THE DILATOMETRIC AND RESISTIVIMETRIC METHODS
Robert Degeimbre and Georges Viatour (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Nov. 1971 65 p refs Sponsored by IRSIA
(CRIF-PL-2) Copyright. Avail: Issuing Activity

Some methods for the measurement of resin crosslinking are listed. Two methods were selected, the resistivitimetric method measuring the curing sample resistivity and the dilatometric method measuring the sample linear shrinkage. Both the methods described were applied to the study of flexible and rigid polyester and epoxy resins. The test results are discussed. It was shown that both methods are applicable to the determination of the post-polymerization thermic cycles, not only for resins but also for laminates. ESRO

N72-20505*# North American Aviation, Inc., Columbus, Ohio.
TITANIUM REINFORCED BORON-POLYIMIDE COMPOSITE Final Report, 27 Jun. 1969 - 1 Jul. 1971
G. A. Clark and K. I. Clayton 27 Jun. 1969 199 p
(Contract NAS8-24511)
(NASA-CR-123549; NR-71H-511) Avail: NTIS

Processing techniques for boron polyimide prepreg were developed whereby composites could be molded under vacuum bag pressure only. A post-cure cycle was developed which resulted in no loss in room temperature mechanical properties of the composite at any time during up to 16 hours at 650 F. A design utilizing laminated titanium foil was developed to achieve a smooth transition of load from the titanium attachment points into the boron-reinforced body of the structure. The box beam test article was subjected to combined bending and torsional loads while exposed to 650 F. Loads were applied incrementally until failure occurred at 83% design limit load. Author

N72-20506*# Stanford Research Inst., Menlo Park, Calif.
EVALUATION OF ADVANCED BLADDER TECHNOLOGY Final Report, 15 Jan. 1969 - 19 May 1971
M. V. Christensen and R. A. Pasternak Jun. 1972 95 p refs
(Contract NAS7-698; SRI Proj. PRU 7758)
(NASA-CR-125819) Avail: NTIS CSCL 11D

Research conducted during this period is reported. Studies presented include: (1) diffusion and permeation of CO2, O2, N2, and NO2 through polytetra fluoroethylene; (2) diffusion, permeation and solubility of simple gases (CO2, O2, N2, CH4, C2H6, C3H8, and C2H4) through a copolymer of hexafluoro propylene and tetrafluoro ethylene (FEP); (3) viscous flow and diffusion of gases throug small apertures; (4) diffusion and permeation of O2, N2, CO2, CH4, C2H6, and C3H8 through nitroso rubber; and (5) results of gas transport studies with carborane siloxane, nitroso rubber, silicone membrane, krytox coating on teflon, and FEP coated glass cloth. Publications generated under this program are listed. F.O.S.

N72-20507*# Los Alamos Scientific Lab., N.Mex.
CMB-13 RESEARCH ON CARBON AND GRAPHITE Summary of Progress, 1 May - 31 Jul. 1971
Morton C. Smith Mar. 1972 23 p refs
(NASA Order W-12595; Contract W-7405-eng-36)
(NASA-CR-125823; LA-4896-PR; Rept-18) Avail: NTIS

CSCL 11D

Preliminary results of the research on carbon and graphite accomplished during this report period are presented. Included are: particle characteristics of Santa Maria fillers, compositions and density data for hot-molded Santa Maria graphites, properties of hot-molded Santa Maria graphites, and properties of hot-molded anisotropic graphites. Ablation-resistant graphites are also discussed. F.O.S.

N72-20508*# TRW Equipment Labs., Cleveland, Ohio.
RESIN/GRAPHITE FIBER COMPOSITES
P. J. Cavano, R. J. Jones, and R. W. Vaughan 1 Mar. 1972 166 p refs
(Contract NAS3-13203)
(NASA-CR-72983; TRW-ER-7396-F) Avail: NTIS CSCL 11D

High temperature resin matrices suitable for use in advanced graphite fiber composites for jet engine applications were evaluated. A series of planned, sequential screening experiments with resin systems in composite form were performed to reduce the number of candidates to a single A-type polyimide resin that repetitively produced void-free, high strength and modulus composites acceptable for use in the 550 F range for 1000 hours. An optimized processing procedure was established for this system. Extensive mechanical property studies characterized this single system, at room temperature, 500 F, 550 F and 600 F, for various exposure times. Author

N72-20509# Technische Univ., Berlin (West Germany). Fachbereich 6.
MEASUREMENTS AND SIMULATIONS OF ELECTRON SPIN RESONANCE SPECTRA OF SOME TRANSITION COMPLEXES IN LOW VISCOUS SOLUTIONS AS WELL AS OF ISOTROPIC AND NEMATIC GLASSES Ph.D. Thesis [MESSUNG UND SIMULATION VON ESR-SPEKTREN EINIGER UEBERGANGSMETALLKOMPLEXE IN NIEDRIG VISKOSER LOESUNG SOWIE IN ISOTROPEN UND NEMATISCHEN GLAESERN]
Gerd Heppke 15 Feb. 1971 115 p refs In GERMAN
Avail: NTIS

Electron spin resonance studies on phenyl lithium complexes are the observed g- and A-factors of V-, Nb-, Ta-, and NbH-complexes at room temperatures and their temperature dependencies are presented. It is shown that nematic N(p-methoxy benzyliden)-p-n-butyl aniline solidifies in a glassy form during rapid cooling and that the ordering of vanadyl acetyl acetonates that it contains, and which is determined through magnetic field polarization, remains mostly unchanged. The signal intensity dependence of the powder crystal spectrum is used to determine probable molecular orientation. Transl. by G.G.

N72-20510*# Translation Consultants, Ltd., Arlington, Va.
SOME NEW CATION-RICH TERNARY OXIDES OF THE MeMO TYPE
H. Sabrowsky Washington NASA Apr. 1972 9 p refs Transl. into ENGLISH from Z. fuer Anorganisch und Allegemeine Chemie (West Germany), v. 365, 1969 p 146-151
(Contract NASw-2038)
(NASA-TT-F-14199) Avail: NTIS

In the system Me2O-M2O (Me - alkali metals, M = Cu, Ag, Au), there exists a number of MeMO compounds with a KAgO structure, in which M4O4 exists as ring units. Compounds of this type with the same alkali metal have axes of the same length along (001). The RbAgO aligned within this structural type (a = 10.1, c = 5.79A; Z = 8). KTlO and RbT1O, both red, crystallize monoclinically, however, according to single-crystal studies. (KTlO: a = 12.9, b = 3.62, c = 6.29 A, beta = 106.5 deg, Z = 4; RbTlO: a = 11.2, b = 3.52, c = 15.2 A; beta = 107 deg, Z = 8). Author

N72-20511*# Translation Consultants, Ltd., Arlington, Va.
LITHIUM ALUMINATES, 2: Li5AlO4
H. A. Lehmann and H. Hesselbarth Washington NASA Apr. 1972 6 p refs Transl. into ENGLISH from Z. Anorg. Allgem. Chem. (Liepzig), v. 315, 1962 p 14-18
(Contract NASw-2038)
(NASA-TT-F-14191) Avail: NTIS CSCL 11D

Heating Li2CO3 and alpha-A12O3 at 600 deg gave the low temperature form of LiA1O2 and only 1 mole CO2/mole Al2O3, independent of reactant mole ratio over the range 1:5-5:1. Li2O and alpha-Al2O3 (5:1 mole ratio) at 500 deg gave Li5AlO4, d25 = 2.23 g/cc. The X-ray powder diffractions of Li5AlO4 and Na5AlO4 were detected. Author

N72-20512*# United Aircraft Corp., East Hartford, Conn. Research Labs.
DETERMINING AND ANALYZING THE STRENGTH AND IMPACT RESISTANCE OF HIGH MODULUS GLASS Final Report
J. F. Bacon 15 Mar. 1972 72 p refs
(Contract NASw-2209)
(L911105-4) Avail: NTIS CSCL 11D

A number of new glass compositions have been prepared with increased emphasis on compositions without beryllia. Glass preparations have been much more broadly based and have included the eutectic glass fields, and the mullite-rare earth glass systems. Of the new glasses, the best non-toxic composition is UARL 472 with a bulk modulus of only 18.20 million psi. A second experimental glass, UARL 417, was chosen for research in making large quantities of fiber in monofilament form. Tests of these UARL 417 epoxy resin samples in comparison to similar composites made with the DuPont organic fiber, PRD-49-1, show that the UARL composites have a compressive strength 41/2 times higher and a specific compressive strength at least 21/2 times greater. Much of the research effort attempted to answer the question of why a given glass should have an impact strength superior to other glasses. No definitive answer to the question was found. Author

N72-20513# Bendix Corp., Kansas City, Mo.
CONFORMAL COATING FY71-3 Quarterly Report
W. F. Moyle Jul. 1971 23 p
(Contract AT(29-1)-613)
(BDX-613-536) Avail: NTIS

To determine more reliable methods of applying polyurethane coating material, tests were made to establish some of the lesser known characteristics of the material. Most of the testing concerns polyurethane coating material. Experiments were made to determine a method for applying bubble-free coatings of Laminar X-500 (polyurethane). These tests were expanded to evaluate the dielectric strength of the coating. Two hundred grams of coating material were thinned with 30 grams of toluene. This thinned material was applied by dipping. Sets of one, two, three, and four coats were applied with about 20 minutes of room temperature cure between multiple coats. Each dip gave a bubble-free coating about 0.001 inch thick. Author

N72-20514# Bendix Corp., Kansas City, Kans.
STRESS-CRACKING AND FRACTURE TOUGHNESS OF POLYCARBONATE MATERIAL
F. W. LaMar Jul. 1971 98 p refs
(Contract AT(29-1)-613)
(BDX-613-512) Avail: NTIS

Stress cracks in polycarbonate material, deterimental to the service life of polycarbonate parts, were tested. Specimens dead-loaded in tension and exposed to normal and humid atmospheres developed large, numerous stress cracks and are expected to fail. It was found that stress cracks shorten fatigue life and occur readily at stress levels well below polycarbonate yield strength in tensile creep, fatigue, and multiaxial tension tests. Author

N72-20515# Sandia Labs., Albuquerque, N.Mex.
CONSTITUTIVE EQUATIONS FOR COMPACTION OF POROUS MATERIALS

Walter Herrmann 1971 55 p refs Presented at the Ann. Meeting of the Am. Soc. of Mech. Engr., Washington, D. C., 28 Nov. 1971 Sponsored by AEC
(SC-DC-714134) Avail: NTIS

The development of constitutive equations to describe the behavior of porous material during shock compaction processes is described. Consideration is given to the effects of temperature variations, low pressure, low stresses, and the thermodynamic behavior. The effects of inclusion rate on compaction along with the three dimensional motions in the materials are described.
E.H.W.

N72-20516# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Manufacturing Research and Product Development Dept.
MEASUREMENTS ON THE EFFECTS OF VACUUM-UV EXPOSURES ON THERMOPLASTIC FILMS
L. Godfried 27 Oct. 1971 55 p
(Contract ESTEC-647-69-AA)
(R-1435-TR-6) Avail: NTIS

In order to investigate the effects of space environment on thermoplastic films, vacuum-ultraviolet exposures up to twenty days were carried out on polytetrafluoro ethylene, polycarbonates, polypropylene, fluoro propylen ethylene, polyphenyl oxides, and a polyester, the PTGE. The best resistance against the test environment was obtained with the fluoro propyl ethylene, immediately followed by polytetrafluoro ethylene. Polyphenyl oxide gave reasonable results but the weight loss was high for polyphenyl oxide as well as for polypropylene. The other materials showed a considerable loss in mechanical properties.
ESRO

N72-20517# Sud-Aviation, Cannes (France). Service Thermique.
STABLE THERMO-OPTICAL COATINGS: BIBLIOGRAPHICAL SYNTHESIS AND DEVELOPMENT PLAN [REVETEMENTS THERMOPTIQUES STABLES: SYNTHESE BIBLIOGRAPHIQUE ET PLAN DE DEVELOPPEMENT]
Cerruti and Girard 16 Sep. 1970 40 p refs In FRENCH
(GTC-368-58) Avail: NTIS

Since the paints normally used for passive thermal control of satellite structures usually have an unstable solar absorptance/hemispheric emission coefficient ratio, several other means of thermal control were studied. These included metal coatings on metal substrates with one or more transparent protective coatings, metal coatings on plastic substrate with one or more transparent protective coatings, and metal coatings on the back of a transparent metal film. A bibliographic survey of present knowledge is given and avenues for further development are examined.
ESRO

N72-20518# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
BEHAVIOR OF DIFFERENT POLYMERIC FILMS UNDER IONIZING IRRADIATION IN SPACE ENVIRONMENT [COMPORTEMENT SOUS IRRADIATIONS IONISANTES EN AMBIANCE SPATIALE DE DIFFERENTS FILMS POLYMERES]
A. Paillous Oct. 1971 130 p refs In FRENCH Sponsored by CNES
(ONERA-NT-03-7) Avail: NTIS

The behavior of polymeric films subjected to 600 keV electron irradiation and 1.5 MeV proton irradiation was investigated. Various optical, mechanical, and electrical properties were measured in order to evaluate the degradation of polymers in a space environment. The polymers studied were polyethylene terephthalate, polyimides, polychloro-trifluoro-ethylene, and polyvinyl fluoride.
ESRO

N72-20519# Research Association of British Paint, Colour and Varnish Manufacturers, Teddington (England).
MECHANICAL PROPERTIES OF PAINT FILMS IN RELATION TO THEIR USE ON AIRCRAFT
J. L. Prosser London Dept. of Trade and Ind. 1971 88 p refs
(Contracts PD/23/058/ADM; KS/1/0629/CB43(A)2)
(D-MAT-165) Avail: NTIS

The mechanical properties of paint films and the changes occurring in them caused by accelerated weathering, are measured. The films were examined with reference to their use on aircraft. A sonic pulse method was used to measure the glass transition temperature of the films. These measurements indicate a rise in Tg (transition temperature) upon weathering which rapidly becomes higher than ambient in all cases. The brittle point was determined from measuring the extensibility at various temperatures. The significance of transition temperatures is discussed and some hypotheses are given for their deviation from glass transition temperatures. Cooling and internal stress effects on cracking are also discussed. Weight losses and their relation to Tg were determined. No changes were observed for adhesion during exposure tests. Preliminary examination of paints under vibration indicate the possibility of extensibility failure at low values due to a fatigue mechanism.
Author (ESRO)

N72-20520# Rome Univ. (Italy). Inst. of Physics.
EFFECT OF ETCHING INTERRUPTIONS ON TRACK FORMATION IN PLASTICS
G. Baroni, S. Dilliberto, G. Romano, C. Sgarbi, and M. C. Tabasso 5 Jun. 1971 25 p refs
(Nota-Interna-321) Avail: NTIS

The effect of etch interruptions on track formation was studied in nitrocellulose plastic sheets using alpha particle tracks. The step effect is markable on some parameters of the tracks while on others, as the lengthening with development time, it seems to be absent. An attempt is made to interpret this effect based on the known dissolution properties of polymers.
Author (ESRO)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-20521 RAND Corp., Santa Monica, Calif.
INTRODUCTION TO STATISTICS AND DATA ANALYSIS WITH COMPUTER APPLICATIONS, 1
Carl Morris and John Rolph Sep. 1971 172 p refs
(P-4695) Copyright. Avail: Issuing Activity

The materials used in the statistical and data analysis course are presented. Topics covered include: histograms and descriptive statistics; measures of dispersion, distance, and goodness of fit; using JOSS for data analysis; binomial distribution and normal approximation; and testing in correlation and regression.
F.O.S.

N72-20522 RAND Corp., Santa Monica, Calif.
INTRODUCTION TO STATISTICS AND DATA ANALYSIS WITH COMPUTER APPLICATIONS, 2
Carl Morris and John Rolph Sep. 1971 127 p refs
(P-4696) Copyright. Avail: Issuing Activity

Material is presented which was used in the second segment of a Statistics and Data Analysis course given in the Rand Graduate Institute in Policy Analysis during April 1971 through June 1971. It is assumed that students do not know calculus.
Author

N72-20523 Mitsubishi Heavy-Industries, Ltd., Tokyo (Japan).
SELF ADJOINT DIFFERENTIAL EQUATIONS AND VARIATIONAL PRINCIPLES, PART 2
Tsutomu Fujino 1972 11 p refs In JAPANESE; ENGLISH

summary
(TB-76-Pt-2) Copyright. Avail: Issuing Activity

A variational principle which derives the self adjoint differential equations of the fourth and sixth orders is studied. The variational principle referring to the higher order differential equations is important for the application of the finite element method to analyze physical phenomena, such as the lateral deflections of a beam or flat plate without shear deformation.

Author

N72-20524# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
A SPECTRAL REPRESENTATION FOR COULOMB WAVE FUNCTIONS
J. Townsend, G. Feldman, and T. Fulton [1955] 14 p refs Sponsored in part by NSF
Avail: NTIS

A simple spectral representation was obtained for the momentum space wave functions of the Schroedinger equation with a Coulomb potential in the form of a contour integral. Both the bound state and the scattering solutions are evaluated as residues at the poles enclosed by this contour. Author

N72-20525*# North Carolina State Univ., Raleigh. Applied mathematics Research Group.
A TRANSFORMATION APPROACH TO OPTIMAL CONTROL PROBLEMS WITH BOUNDED STATE VARIABLES Ph.D. Thesis
Lawrence Michael Hanaly 1971 66 p refs
(Grant NGL-34-002-032)
(NASA-CR-112040) Avail: NTIS CSCL 12A

A technique is described and utilized in the study of the solutions to various general problems in optimal control theory, which are converted in to Lagrange problems in the calculus of variations. This is accomplished by mapping certain properties in Euclidean space onto closed control and state regions. Nonlinear control problems with a unit m cube as control region and unit n cube as state region are considered. K.P.D.

N72-20526# RAND Corp., Santa Monica, Calif.
QUALITATIVE INCONSISTENCY IN THE TWO REGRESSOR CASE
Bob Ayanian Oct. 1971 8 p ref
(P-4720) Avail: NTIS

An investigation of the qualitative inconsistency in a two regressor model in an economic context is presented. Error terms are also discussed. Author

N72-20527# Technische Hochschule Darmstadt (West Germany).
ON THE INDIRECT CONVEY OPTIMIZATION Ph.D. Thesis [UEBER MITTELBAR KONVEXE OPTIMIERUNG]
Reiner Horst 1971 78 p refs In GERMAN
Avail: NTIS

A numerical analysis of indirect convex optimization is presented. Subjects discussed are: (1) indirect convex and indirect concave functions, (2) indirect convex optimization, (3) treatment of penalty functions, (4) treatment of barrier functions, and (5) sectional plane procedure. Mathematical models are included to support the theoretical considerations.

Transl. by P.N.F.

N72-20528# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON THE DECOMPOSITION OF LIMITATIONS ON CERTAIN IRREDUCIBLE REPRESENTATIONS OF THE NONCOMPACT LORENTZ GROUP TO THE COMPACT LORENTZ GROUP AND THE ROTATION GROUP OF THE R(3) Ph.D. Thesis [UEBER DIE ZERLEGUNG DER EINSCHRAENKUNG GEWISSER IRREDUZIBLER DARSTELLUNGEN DER INHOMOGENEN LORENTZGRUPPE AUF DIE HOMOGENE LORENTZGRUPPE UND DIE BEWEGUNGSGRUPPE DES R(3)]
Gerhard Zumbusch 9 Jul. 1971 113 p refs In GERMAN
Avail: NTIS

Limitations on some steady irreducible unitary representations for the universal superimposed group of the noncompact Lorentz group to the three dimensional rotation group and the compact Lorentz group are considered, with emphasis on the SU(2) group. A Lie algebra method for a dense linear partial space is used to obtain direct integral decomposition and infinite operators for physical interpretations of the spectral unitary elements.

Transl. by G.G.

N72-20529# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
STATISTICAL METHOD OF CALCULATING AVERAGES IN DUAL RESONANCE MODELS
M. I. Gorenstein (Inst. for Theoret. Phys., Kiev), V. I. Makarov (Inst. for Theoret. Phys., Kiev), V. A. Miransky (Inst. for Theoret. Phys., Kiev), V. P. Shelest, and G. M. Zinovjev (Inst. for Theoret. Phys., Kiev) Jan. 1972 14 p refs Submitted for publication
(RIFP-138) Avail: NTIS

A Statistical treatment of the system of levels in a dual resonance model was employed to calculate the distribution of resonance spins. The possible interpretation of energy fluctuations in such systems is discussed. Author

N72-20530# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
STATISTICAL METHOD FOR DETERMINING A LOWER LIMIT [METHODE ZUR STATISTISCHEN BESTIMMUNG EINER UNTERGRENZE]
C. A. Hermens 10 Aug. 1970 25 p In DUTCH
(SM-66) Avail: NTIS

Numerical methods for determining the lower limit of a mathematical relationship are presented. Mathematical models based on the probability theory are used to explain the steps taken. Examples of random tests are provided to support the theoretical aspects of statistical analysis techniques. Graphs are included for the following: (1) one sided tolerance factors for normal distribution, (2) the divisor for evaluation of the standard distribution, (3) correction factors for evaluation of mean values, and (4) results of 11,600 determinations of lower boundaries.

Transl. by P.N.F.

N72-20531# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Freiburg (West Germany). Inst. fuer Angewandte Mathematik und Mechanik.
EXISTENCE AND UNIQUENESS OF THE SOLUTION OF A SYSTEM OF INTEGRO-DIFFERENTIAL EQUATIONS FOR RADIATIVE ENERGY TRANSPORT
H. Spreuer 1971 193 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-45) Avail: NTIS; DFVLR Porz-Wahn: 42,60 DM

Existence and uniqueness are shown for the solution of the problem of transfer of energy, which is not necessarily spherically symmetric, in a rigid sphere. The solution is bracketed and approximated with arbitrary accuracy by sequences of rigorously valid bounds. Even though the problem considered is not of monotonic type, the bounds are constructed by use of linear auxiliary problems of this type. It is possible to evaluate the bounds numerically. Author

N72-20532# Oslo Univ. (Norway). Inst. of Physics.
ISOTROPIC LIMITING BEHAVIOUR OF THE SIX-DIMENSIONAL FORMALISM OF ANISOTROPIC DISLOCATION THEORY AND ANISOTROPIC GREENS FUNCTION THEORY. PART 2: PERTURBATION THEORY THE ISOTROPIC N-MATRIX
Kazumi Nishioka and Jens Lothe [1972] 19 p refs
Avail: NTIS

Perturbation expansions in terms of the deviation from isotropy are developed for the eigenvalues and eigenvectors of

the N-matrix, which appears in the six-dimensional formalism for anisotropic dislocation theory and anisotropic Green's function. The strongly degenerate behavior in the limit of isotropy is elucidated. It is shown that divergent terms cancel themselves in certain sums to leave well-behaved isotropic limits. It was necessary to develop a perturbation method applicable to a non-semisimple matrix. Author

N72-20533# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE DETERMINATION OF THE ORIENTATION OF A MOVING OBJECT BY ITS ANGULAR VELOCITY
Iv. V. Levi 8 Jan. 1971 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela (Moscow), no. 6, 1971 p 7-13
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The error in determining the orientation of a moving object caused by the inaccuracy in determining the vector of its absolute angular velocity is considered. Solution of the system of Poisson variational equations is represented as an infinite product of orthogonal matrices. The radius of convergence of this product is determined. By using majorants, the error caused by replacement of the infinite product by the product of a finite number of its first members is estimated in a number of cases. A limiting case of integration of the Poisson equations is examined. Author

N72-20534# Bochum Univ. (West Germany).
NEUTRALIZATION OF MULTIVARIABLE SYSTEMS WITH MINIMUM ORDER REGULATION Ph.D. Thesis [ENTKOPPLUNG VON MEHRGROESSEN-SYSTEMEN MIT REGLERN MINIMALER ORDUNG]
Michael Cremer 12 Feb. 1970 134 p refs In GERMAN
Avail: NTIS

A synthesis method was developed with which linear, time invariant, multivariable systems were analyzed mathematically. The principle of decoupling and its application for minimum order regulation is discussed. Examples of the numerical analysis of minimum order regulation are presented. Mathematical matrices are developed to support the theoretical considerations. The application of the mathematical models to the development of a regulated servo is demonstrated. An example is given to show how existing degrees of freedom are required by the regulator synthesis in order to improve the disturbance response.
Transl. by P.N.F.

N72-20535# Washington Univ., Seattle. Dept. of Chemical Engineering.
ERROR BOUNDS FOR APPROXIMATE SOLUTIONS TO NONLINEAR ORDINARY DIFFERENTIAL EQUATIONS
Noble B. Ferguson and Bruce A. Finlayson 1971 29 p refs (Grant NSF GK-12517)
Avail: NTIS

Error bounds are provided for approximate solution of systems of nonlinear ordinary differential equations for cases where there is no known exact solution for comparison. Theorems are proved for problems of heat and mass transfer of a multicomponent system in catalyst particles undergoing chemical reaction. Error bounds are provided for the pointwise error as well as the effectiveness factor. Calculations based on the theorems show the orthogonal collocation method can give results which are proved accurate to 12 digits, thus providing essentially the exact solution. For problems for which the theorems have not yet been proved, the results suggest that the mean-squared residual gives a good indication of the accuracy since the error decreases as the mean-squared residual decreases. Author

N72-20536# Akademiya Nauk URSR, Kiev. Inst. teoreticheskoi Fiziki.
ON THE PARAMETRIC FUNCTIONS OF NONRENORMALIZED FEYNMAN AMPLITUDE
V. I. Kucheriaviy 1971 23 p refs In RUSSIAN; ENGLISH summary
(ITF-71-46-P) Avail: AEC Depository Libraries

A method for finding the parametric functions of the Feynman integral with the use of circuit, path, and circuit-path matrices is proposed. Definitions of the above matrices are introduced, and some of their properties are indicated. The parametric functions of the Feynman integral are expressed via these matrices by mean of simple analytical expressions. Author

N72-20537# National Physical Lab., Teddington (England). Div., of Quantum Metrology.
THE NORMAL FORM OF A COMPLEX SKEW-SYMMETRIC MATRIX
R. J. Bell Nov. 1971 11 p refs
(NPL-NAC-9) Avail: NTIS

The transformation of a general complex skew matrix to a normal near-diagonal form, developed for a real skew symmetric matrix is considered. It is found that in this case, the matrix can be brought to the near diagonal form by a transformation matrix resembling a unitary but generally not real orthogonal matrix. The problem of the asymmetric unitary transformation is discussed and the result is applied to a skew symmetric matrix. ESRO

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-20538 National Lending Library for Science and Technology, Boston Spa (England).
ON THE STATISTICAL PARAMETERS OF INDICES OF SIMILARITY BETWEEN METEOROLOGICAL FIELDS
A. M. Soldatkina [1971] 9 p ref Transl. into ENGLISH from Sredneaziat. Nauch. Issled. Gidromet Inst. (Leningrad), v. 47, no. 62, 1970 p 22-29
(NLL-M-22078-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The statistical parameters concerning synoptic situations at successive times in meteorological fields are determined. From these parameters, analogs are developed and used to predict meteorological fields and elements. E.H.W.

N72-20539 Deutscher Wetterdienst, Offenbach am Main (West Germany).
INVESTIGATIONS INTO THE METEOROLOGICAL INFLUENCES ON THE DISPERSION OF NOXIOUS GASES. [UNTERSUCHUNGEN UEBER METEOROLOGISCHE EINFLUESSE AUF DIE AUSBREITUNG VON SCHADGASEN]
Gerhard Manier 1971 86 p refs In GERMAN; ENGLISH summary
(Rept-124-Vol-16) Avail: Issuing Activity

Three investigations into the meteorological influences on the dispersion of noxious gases are presented. Frequency distribution of diffusion categories and wind speed were calculated based on five years of synoptic weather observations. A method to correct frequency distributions of diffusion conditions and to calculate them for frequency distributions of wind speed or from mean wind speed was developed. An investigation to determine the effects of wind direction, wind speed, and atmospheric turbulence on dispersion of noxious gases was conducted.
Author

N72-20540 Deutscher Wetterdienst, Offenbach am Main (West Germany).
EXPERIENCES AND OBSERVATIONS WITH LIDAR AT THE AACHEN METEOROLOGICAL OBSERVATORY

[ERFAHRUNGEN UND UEBERLEGUNGEN MIT LIDAR AM METEOROLOGISCHEN OBSERVATORIUM AACHEN]
H. Borchardt and J. Roessler 1971 35 p refs In GERMAN; ENGLISH summary
(Rept-125-Vol-16) Avail: Issuing Activity

The development and characteristics of a laser-radar system, called lidar, which is used for meteorological observations are discussed. Examples of the application of lidar in tropospheric work to demonstrate the basic methods of cloud height measurement and the possibilities of sounding are presented. A lidar system is described which permits the separation of backscatter and extinction under tolerable atmospheric assumptions and special technical conditions. Author

N72-20541 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 123, NO. 1: DAILY ALTITUDE MAPS OF THE 100 mb LEVEL AND THE 50 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1971, PART 1 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 123, HEFT 1: TAEGLISCHE HOEHENKARTEN DER 100 mb FLAECHE UNDDER 50 mb FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1971. TEIL 1, 1. VIERTELJAHR]
1971 218 p In GERMAN; ENGLISH summary
(QR-1-Pt-1) Avail: Issuing Activity

A series of stratospheric weather maps published since 1957 by the Meteorological Institute of the Free University of Berlin, Germany are presented. The daily height and temperature analysis of constant pressure levels for three months for the whole of the Northern Hemisphere is published. The information is based on rawinsonde and rocketsonde data performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included, as well as the mean gridpoint data, calculated from daily values. Stratospheric circulation of polar, middle, and tropical latitudes is described for the period considered. Author

N72-20542 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 120, NO. 9: RESULTS OF SYNOPTIC SERVICE DURING 1971. DAILY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, SEPTEMBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 120, HEFT 9: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1971, TAEGLICHE WETTERKARTEN (BODEN, 500 MB), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, SEPTEMBER]
1971 183 p refs In GERMAN
Avail: Issuing Activity

Daily weather charts from the ground to the 500 millibar level with tables and scientific notations are presented. The reports cover the atmospheric conditions existing over Berlin, Germany during the month of September, 1971. P.N.F.

N72-20543 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 122, NO. 4: AEROLOGICAL DATA, BERLIN-TEMPELHOF, APRIL 1971 [METEOROLOGISCHE ABHANDLUNGEN. BAND 122, HEFT 4: AEROLOGISCHE DATEN, BERLIN-TEMPELHOF, APRIL 1971]
1971 167 p refs In GERMAN; ENGLISH summary
Avail: Issuing Activity

The results of radiosonde ascents performed by the aerological station of the Institute for Meteorology of the Free University of Berlin, Germany are presented. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The temperature curve of the climatological mean and the data of the ozone ascents are given in tabular and graphic form. Author

N72-20544 World Meteorological Organization, Geneva (Switzerland).
INVESTIGATIONS ON THE CLIMATIC CONDITIONS OF THE ADVANCEMENT OF THE TUNISIAN SAHARA
H. Flohn 1971 41 p refs In ENGLISH and FRENCH
(OMM/WMO-279; Tech-Note-116) Copyright. Avail: WMO, Geneva: Sw. Fr. 6

Increasing agricultural activities in the semi-arid boundary zone of the Sahara Desert in Tunisia have introduced changes in the natural conditions and it has been suspected that some of these changes may be permanent in nature. The significant factors in the water balance of this area is described. A description of the water-budget factors characteristic of an area on the edge of a continental desert is made. It is noted that, in such an area, a delicate balance is maintained between precipitation, evapotranspiration, runoff and change in ground water storage. On a long-term basis and under natural conditions the two latter factors approach zero so that the varying annual conditions are reflected solely in precipitation and evapotranspiration. By changing natural conditions, however, it is pointed out that there is a very real risk of upsetting the balance. The precipitation regime of the region is described. Using records for the past sixty years from ten climatological stations it is shown that, although precipitation varies greatly from year to year, no long-term upward or downward trend can be identified. A description of the actual evapotranspiration from this region based on the total precipitation plus the amount of irrigation water supplied to areas under cultivation is presented. Potential evapotranspiration is estimated and the effect of advected energy, the oasis effect, on evapotranspiration is described.
Author (ESRO)

N72-20545 World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: THE PLAN AND IMPLEMENTATION PROGRAMME 1972-1975
Jul. 1971 88 p
(WMO-296) Copyright. Avail: WMO, Geneva

The World Plan for 1972-75 constitutes the basis for continued action to be taken by the WMO. The concepts and principles of the WMO programs are included herein as well as the results and experience of WMO members. Among the items covered specifically are the global observing system, data processing system, and telecommunication system. ESRO

N72-20546 World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: FOURTH STATUS REPORT ON IMPLEMENTATION
Jul. 1971 295 p
(WMO-308) Copyright. Avail: WMO, Geneva

The present situation and the improvements which may be expected in the years to come concerning the Global Observing System, Global Data-processing System, and Global Telecommunication System respectively, are summarized. Wherever possible, the methods whereby the improvements may be expected (i.e. national resources, UNDP, bilateral, VAP) are also given. Information is provided on the progress of the implementation of observing, data-processing, and telecommunication facilities in the past. Author (ESRO)

N72-20547# National Weather Service, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES NATIONAL METEOROLOGICAL CENTER, SECOND HALF 1971
Feb. 1972 51 p refs
Avail: NTIS

The numerical weather prediction activities of the National Meteorological Center (NMC) for the last half of 1971 are summarized. During that period, a limited-area fine-mesh (LFM) forecasting model was implemented, an innovative initialization procedure was incorporated into the coarse-mesh six-layer primitive equation (PE) model, and a comprehensive effort was

begun to adapt the Air Force Global Weather Central boundary layer model to function in the NMC environment. Also included are summaries of recent developments in data automation and verification statistics for the LFM and PE models. Author

N72-20548# RAND Corp., Santa Monica, Calif.
PARAMETERIZATION OF ICE GROWTH FOR NUMERICAL CALCULATIONS OF CLOUD DYNAMICS
L. R. Koenig Jul. 1971 32 p refs
(Contract NOAA-E22-17-71(N))
(R-846-NOAA) Avail: NTIS

Parametric equations describing the growth of ice particles in the range 10 to the minus 11th power g to 1 g are presented. Three sub-ranges (10 to the minus 11th power to 5 x 10 to the minus 8th power to 0.0001, and 0.0001 to 1 g) are used. The parametric equations were developed with the aid of a complex method of calculating ice-particle growth. Two approaches to using the parametric equations in a simulation resembling a natural cloud situation are described. One method breaks the ice-particle spectrum into three components, the sizes of each being monitored. The other assumes a size distribution that can be characterized by a growth-median size, so that only one size need be monitored to describe the rate of growth. The aprametric method is compared with more complicated methods in a simulated cloud environment, and the results are regarded as satisfactory. Author

N72-20549# RAND Corp., Santa Monica, Calif.
ENVIRONMENTAL PROBLEMS: THEIR CAUSES, CURES, AND EVOLUTION, USING SOUTHERN CALIFORNIA SMOG AS AN EXAMPLE
Alan P. Carlin and George E. Kocher May 1971 120 p refs Sponsored by Carnegie Corp.
(R-640-CC/RC) Avail: NTIS

The identification of the major underlying causes of environmental problems and some of the possible remedies are considered both in general and in the specific case of photochemical air pollution in southern California. Environmental problems arise because of increases in the demands placed on the environment or because of less than optimum management of such demands by society, or both. Accordingly, the underlying causes are taken as those factors that bring about one of these two results. Three of the demand-increasing causes are identified as primary causes, which are relatively difficult to change, namely population growth, growth in per capita income, and use of new technology incompatible with ecological processes; one management-inhibiting cause, imperfections in the economic system, is also so identified. Author

N72-20550# RAND Corp., Santa Monica, Calif.
A COMPARISON OF TIDAL THEORY WITH LOWER THERMOSPHERIC WIND OBSERVATIONS
E. S. Batten May 1971 17 p refs
(P-4655) Avail: NTIS

The wind in the lower thermosphere is generally considered to be composed of prevailing, tidal and gravity wave components. The effects of heat conductivity and the absorption of solar radiation in the thermosphere are added to the tidal theory. The results of comparison of theory with observations indicate that major features of the vapor trail drifts (for example, the wind speed maximum near 105 km, the velocity oscillations below speed maximum and the quiescent region above the speed maximum) can be explained in terms of interference between tidal modes propagation in an atmosphere with dissipation. The results also indicate that variations in water vapor excitation may be a source of the day-to-day changes observed in the S sug q current system. Author

N72-20551*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MEAN OBSERVED METEOROLOGICAL STRUCTURE AND CIRCULATION OF THE STRATOSPHERE AND MESOSPHERE
J. S. Theon, W. S. Smith, J. F. Casey, and B. R. Kirkwood Washington Mar. 1972 80 p refs
(NASA-TR-R-375; G-1037) Avail: NTIS CSCL 04B

Meteorological soundings of the upper stratosphere and mesosphere, conducted with in situ rocket techniques during all seasons of the year from several sites, ranging in latitude from 8 deg S to 71 deg N, are analyzed. The resulting data are compiled into mean monthly and seasonal profiles of temperature, pressure, density, and wind for each site and are presented in graphical and tabular form. Analyses of these mean values produced time cross sections, quasi-meridional cross sections, and constant level maps which are included. Author

N72-20552# France. Direction de la Meteorologie Nationale, Paris.
MOUNTAIN CREST AERODROMES: PRELIMINARY METEOROLOGICAL STUDY OF THE SITE AT COL DE LA LUNE [AERODROMES DE CRETE: ETUDE METEOROLOGIQUE PRELIMINAIRE DU SITE DU COL DE LA LUNE]
M. Berenger and P. Simonet Nov. 1971 55 p refs In FRENCH
(Mono-84) Avail: NTIS

A meteorological study of weather conditions and climatology around alpine areas in France, as observed by several desert stations, is presented. Data cover the effects of land relief on weather modifications, topographic effects, effects of atmospheric turbulence, and the principle characteristics of general meteorology in the area. Also covered are air flow and its effects on cloud and temperature changes. Transl. by E.H.W.

N72-20553# National Oceanic and Atmospheric Administration, Rockville, Md. Geophysical Fluid Dynamics Lab.
ATMOSPHERIC CIRCULATION STATISTICS
Abraham H. Oort and Eugene M. Rasmusson Sep. 1971 337 p refs
(NOAA-Paper-5) Avail: SOD $3.00 as 0317-0045

Extensive compilations and a critical discussion of zonally averaged, monthly, and seasonal statistics describing the atmospheric circulation in the Northern Hemisphere are presented. Material within the General Circulation Library of the Massachusetts Institute of Technology, covering the period from May 1958 through April 1963, forms the principal data set. The parameters are wind components, temperature, geopotential height, and specific humidity. The mean values, variances, and meridional transports of these parameters are presented as a function of latitude between 10 deg S and 70 deg N and as a function of height between the earth's surface and 50 mb. In addition, the vertical transports by the stationary eddies and the mean meridional circulation are presented. A few selected statistics are also presented for individual midseason months from the 5-year sample. These statistics indicate that systematic interannual changes are restricted mainly to the tropical and polar stratosphere. Author

N72-20554# Transportation Systems Center, Cambridge, Mass.
CLEAR AIR TURBULENCE RADIOMETRIC DETECTION PROGRAM Annual Report, 1 Jul. 1970 - 30 Jun. 1971
George W. Wagner, G. G. Haroules, and W. E. Brown Jul. 1971 62 p
(DOT-TSC-FAA-71-19) Avail: NTIS

Accomplishments for the Clear Air Turbulence Detection Program are discussed. The objectives, instrumentation, supporting hardware and interfaces leading up to and including the test flights for the reporting period are given. The ultimate goal of this program is the development of a remote method for detecting and thereby alerting high-altitude, high-speed aircraft in sufficient time to avoid the hazards associated with clear air turbulence, CAT. Author

N72-20555# National Oceanic and Atmospheric Administration, Washington, D.C.
USE OF SATELLITE DATA IN EAST COAST SNOWSTORM

FORECASTING
Frances C. Parmenter Feb. 1972 26 p refs
(NOAA-TM-NESS-33) Avail: NTIS

The satellite-observed cloud features which can be used to detect areas of cyclogenesis and areas of heavy precipitation within these coastal storms are summarized. Satellite data are most useful for detecting the initial stages of east coast cyclogenesis and for tracking developing of mature storm systems. Certain features within the associated cloud pattern define the areas of heaviest precipitation and permit a more accurate prediction of the duration of heavy precipitation.
Author

N72-20556# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Meteorological Physics.
[RESEARCH PROGRAMS IN METEOROLOGICAL PHYSICS] Annual Report, 1970 - 1971
1971 47 p
Avail: NTIS

Research in meteorological physics and supporting activities are summarized. Investigations on dynamic and synoptic meteorology, atmospheric and terrestrial radiation, micrometeorology, and agricultural meteorology are emphasized. Environmental quality, upper atmopshere, and atmospheric conditions during forest fires are also studied. N.E.N.

N72-20557# National Oceanic and Atmospheric Administration, Washington, D.C.
APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ANALYSIS AND FORECASTING, SUPPLEMENT
Ralph K. Anderson and Arthur H. Smith Nov. 1971 66 p refs
(ESSA-TR-NESC-51-Suppl; NOAA-AWS-TR-212) Avail: SOD $0.65

The basic characteristics of infrared data, and interpretation of cloud forms and surface features are discussed. A comparison is made of IR imagery and TV pictures of land and clouds, and the effects of temperature variations on IR pictures are described. Details are given on interpreting IR pictures of cirrus and middle clouds, cumulus clouds, fog and stratus layer, as well as the earth's surface during daytime and nightime, and during summer and winter. Instrumentation and resolution, data processing, and conditions affecting the imagery are also considered. (This is chapter 6 of N70-17905.) N.E.N.

N72-20558# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, APRIL 1971
Apr. 1971 296 p refs
Avail: NTIS

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N72-20559# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, MAY 1971
May 1971 302 p refs
Avail: NTIS

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N72-20560# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JUNE 1971
1971 313 p refs
Avail: NTIS

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N72-20561# Atomic Energy Commission, Washington, D.C. Div. of Biology and Medicine.
MATHEMATICAL ANALYSIS OF THE EFFECTS OF WIND ON REDISTRIBUTION OF SURFACE CONTAMINATION
Amelio J. Amato Sep. 1971 7 p refs
(WASH-1187) Avail: NTIS; SOD $0.25

A theoretical model was formulated to predict the long range, time and space redistribution by wind of surface contamination. Creep, saltation, suspension (followed by diffusion and deposition), and weathering are considered to effect a one dimensional flow pattern spatially described by an unlimited number of continuous intervals. Within each interval, the contamination concentration is described as a function of time by a first order differential equation. Possible applications and extensions are discussed. Author(NSA)

N72-20562# Illinois State Water Survey, Urbana.
STUDY OF RAINOUT OF RADIOACTIVITY IN ILLINOIS Progress Report
Richard G. Semonin Nov. 1971 33 p refs
(Contract AT(11-1)-1199)
(COO-1199-20; PR-10) Avail: NTIS

The field project phase (ITREX) was continued in the St. Louis area as an integral part of Project METROMEX, a field effort to determine the effects of an urban area on precipitation. Unique chemical tracers released into the updrafts of convective clouds were used to estimate the scavenging efficiency of the treated clouds. The design of ITREX as it relates to METROMEX is described, and a few preliminary findings determined from the data collected during the field project period are given.
Author (NSA)

N72-20563# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Oct. 1971 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, OCTOBRE 1971]
1971 16 p In FRENCH and DUTCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during October 1971 are given. ESRO

N72-20564# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Apr. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, AVRIL 1970]
1971 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in April 1970 are presented. ESRO

N72-20565# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, May 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, MAI 1970]
1971 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in May 1970 are presented. ESRO

N72-20566# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Jun. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, JUIN 1970]

1971 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in June 1970 are presented. ESRO

N72-20567# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Aug. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, AOUT 1970]
1971 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in August 1970 are presented. ESRO

N72-20568# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Sep. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, SEPTEMBRE 1970]
1971 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in September 1970 are presented. ESRO

N72-20569# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Nov. 1971 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, NOVEMBRE 1971]
1971 16 p In FRENCH and DUTCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during November 1971 are given. ESRO

N72-20570# Institut Royal Meteorologique de Belgique, Brussels. ig620236
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Mar. 1971 [POLLUTION ATMOSPHERIQUE. FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, MARS 1971]
1971 29 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS

Air pollution data obtained at Belgian weather stations are tabulated. The air pollution apparatus is briefly described. ESRO

N72-20571# World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
REPORT OF THE SIXTH SESSION OF THE JOINT GARP ORGANIZING COMMITTEE
1971 111 p Conf. held at Toronto, 20-25 Oct. 1971 Prepared jointly with Intern. Council of Sci. Unions
Avail: NTIS; WMO, Geneva

The report of the 6th Session of GARP summarizes the GARP numerical experimentation program, the GARP Atlantic tropical experiment (GATE), the first GARP global experiment, the air-surface interaction and radiation subprograms and organization of future work. ESRO

N72-20572# Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 126, NO. 1: THE EUROPEAN CLIMATOLOGY 1971. WEATHER SATELLITE OBSERVATIONS AT THE BERLIN APT STATION, PART 1 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 126, HEFT 1: DAS EUROPAEISCHE WETTERBILD 1971. WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH TEIL 1, 1. VIERTELJAHR]
1971 207 p In GERMAN; ENGLISH summary
(QR-1-Pt-1) Avail: NTIS

Daily cloud mosaics and some orbital data of weather satellites over Europe obtained by the Berlin APT station during the 1st quarter of 1971 are given. ESRO

N72-20573# France. Direction de la Meteorologie Nationale, Paris.
COMPILATION OF AGROCLIMATOLOGICAL DATA. TEMPERATURE SUMS [RECUEIL DE DONNEES AGROCLIMATOLOGIQUES. SOMMES DE TEMPERATURES]
P. Brochet, R. Durand, and N. Gerbier Jun. 1971 149 p refs In FRENCH *Its* Monographie No. 83 de la Meteorol. Natl.
Avail: NTIS

In order to associate the rate of evolution of plants with temperatures, a statistical analysis was made of temperatures recorded at 87 French weather stations from 1948 to 1967. Charts were traced to the mean temperature distribution, the indices of plant development, and of variation coefficients, according to periods corresponding to mean vegetative periods for the principal French crops. It is concluded that the method used is a useful tool for better planning in agriculture. ESRO

N72-20574# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS, SOUTHWEST ASIAN COASTAL MARINE AREAS. VOLUME 4: AREA 13, GULF OF CAMBAY, AREA 14, N. E. ARABIAN SEA, AREA 15, N. W. ARABIAN SEA, AREA 16, S. E. OMAN
Dec. 1971 640 p refs
(AD-734150) Avail: NTIS HC $9.00/MF $0.95 CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas discussed in the report include Cambay Gulf, northeast and northwest Arabian Sea, and southeast Oman. GRA

N72-20575# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
OBSERVATIONS OF THE MEAN WIND PROFILE OVER THE OPEN OCEAN M.S. Thesis
William Dale Groscup Nov. 1971 58 p refs
(Contract N00014-67-A-0204-0024; NR Proj. 083-236)
(AD-734670; Rept-71-7) Avail: NTIS CSCL 04/2

The purpose of this study was to investigate the mean wind speed profile over the open ocean. Analysis of wind profile data showed that averaging periods must be considered when the profile form is discussed since 95 percent of the 10 minute averaged profiles were found to be logarithmic while less than 50 percent of the 10 second averaged profiles were logarithmic. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-20576# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF THE STATIONARY MOTIONS OF A FOUR-GYROSCOPE VERTICAL MOUNTED ON A SATELLITE IN A NEWTONIAN CENTRAL FORCE FIELD
V. I. Popov [1971] 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela (USSR), no. 6, 1971 p 25-28
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The stability of the steady state motions of a four-rotor gyroscopic system, mounted on a satellite in a Newtonian central force field, is investigated by the method of altered potential energy. The problem is solved in a restricted formulation. The point of suspension of the gyroscopic system does not coincide with the center of mass of the satellite. The natural angular velocities of the rotors are considered constant. Author

N72-20577# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A REVIEW OF AIR TRAFFIC CONTROL
Lothar Steigerwald Jul. 1971 266 p refs Sponsored by Natl. Res. Council of Can.
(UTIAS-34) Avail: NTIS

A broad outline and understanding of the basic facts and problems of air traffic control are presented. Congestion and capacity problems are discussed in the light of present ATC organization in North America and Europe. Planning and proposed ATC concepts are presented outlining the different approaches several countries have taken to solve the air traffic congestion problems. In addition, research in air traffic control is being reviewed to determine its impact on future ATC solution. Author

N72-20578# Transportation Systems Center, Cambridge, Mass.
KEYBOARD AND MESSAGE EVALUATION FOR COCKPIT INPUT DATA LINK Technical Report, FY 1971
Edwin H. Hilborn Nov. 1971 40 p refs
(DOT-TSC-FAA-71-21) Avail: NTIS

Some methods for implementation of the man-machine interface of Digital Data Link for Air Traffic Control are discussed. An analysis of information transfer requirements indicated that a vocabulary of less than 200 words could yield meaningful messages for all routine ATC transactions. Keyboard configurations suitable for one-handed operation to yield alphanumeric outputs were studied and a ten-key character selection layout based upon sequential keying of the first two letters of the phonetic alphabet was developed. Tests with experimental subjects indicated that training time was no longer and keying proficiency at least as good as that achieved with a larger keyset. A second-order mnemonic coding scheme based upon key letters of messages was proposed as a means for reducing the number of required keystrokes to generate such messages. Author

N72-20579# Transportation Systems Center, Cambridge, Mass.
PATH CHANGING METHODS APPLIED TO THE 4-D GUIDANCE OF STOL AIRCRAFT
Robert J. Hynes, Lloyd E. Stevenson, and Edward B. Capen (Service Technol. Corp., Cambridge, Mass.) Nov. 1971 41 p refs
(DOT-TSC-FAA-72-5) Avail: NTIS

Proposed terminal area operations may require that large-scale commercial STOL aircraft be capable of accurately flying complex flight paths, and in some situations, maintaining a time of arrival envelope at waypoints along these paths (4-D guidance capability). Problems that arise in performing 4-D guidance, and the results of an initial investigation of two candidate 4-D guidance schemes that are based on the aircraft having a limited amount of protected airspace for maneuvering, are discussed. Preliminary analysis and simulation results are presented and future work on the 4-D guidance of STOLS is outlined. The results, although presented for STOLS, are applicable also to the 4-D guidance of any RNAV equipped aircraft. Author

N72-20580# Transportation Systems Center, Cambridge, Mass.
COLLISION RISK MODEL FOR NAT REGION
Ronald M. Hershkowitz May 1971 55 p refs
(DOT-TSC-FAA-71-6) Avail: NTIS

The essential features of the collision risk model used to analyze the effects of separation standards on safety for the parallel tracking system employed for airline operations in the North Atlantic Ocean are presented. The derivation of the model is traced from a set of basic assumptions to formulation of various philosophies. A set of conclusions and recommendations is included. Author

N72-20581# Transportation Systems Center, Cambridge, Mass.
THE IMPACT OF INERTIAL NAVIGATION ON AIR SAFETY
R. M. Hershkowitz, D. Oathuna, and K. R. Britting (MIT) May 1971 26 p refs
(DOT-TSC-FAA-71-5) Avail: NTIS

An analysis of inertial navigation system performance data was carried out to assess the probable impact of inertial navigation on the aircraft collisions risk in the North Atlantic region. These data were used to calculate the collisions risk between two aircraft flying at the same nominal flight level on adjacent tracks. The inertial system's error sources are treated in a statistical sense to infer the en route error behavior from the terminal error data. Collision risk estimates are derived for easterly and westerly transatlantic flights. There is strong evidence to support the concept that the widespread use of inertial navigators will lead to reduced separation standards in the North Atlantic region while maintaining present safety standards. Author

N72-20582# Transportation Systems Center, Cambridge, Mass.
LARGE SCALE SYSTEMS: A STUDY OF COMPUTER ORGANIZATIONS FOR AIR TRAFFIC CONTROL APPLICATIONS
John Dumanian and David Lapp Jun. 1971 155 p refs
(DOT-TSC-FAA-71-15) Avail: NTIS

Based on current sizing estimates and tracking algorithms, some computer organizations applicable to future air traffic control computing systems are described and assessed. Hardware and software problem areas are defined and solutions are outlined. System evaluation criteria are presented. The objectives, approach, and definitions of computer hardware and software are given. The ATC data processing requirements, the anticipated traffic, the computer processing rates, and the methods for analyzing computer performance are discussed. Current computing systems with capabilities for usage in near future ATC applications described. The algorithms which are to be used in the projected ATC programs are outlined. Author

N72-20583# Transportation Systems Center, Cambridge, Mass.
COMPUTER SYSTEMS PERFORMANCE MEASUREMENT TECHNIQUES
Judith Gertler, Herbert Glynn, Vivian Hobbs, and Frederick Woolfall Jun. 1971 71 p refs
(DOT-TSC-FAA-71-23) Avail: NTIS

Computer system performance measurement techniques, tools, and approaches are presented as a foundation for the instrumentation of air traffic control data processing equipment to measure and evaluate effectiveness. Several computer system measurement approaches, event-monitoring, and statistical sampling software techniques are discussed. Diverse computing environments and the fundamental operational concepts of executive systems are examined. The characteristics of simulation languages and packages are summarized to provide guidelines for evaluation and selection of simulation capability. Author

N72-20584# Transportation Systems Center, Cambridge, Mass.
A CONCEPTUAL NETWORK MODEL OF THE AIR TRANSPORATION SYSTEM: THE BASIC, LEVEL 1 MODEL
Aurel N. deHollan and Arthur S. Priver Apr. 1971 49 p
Original contains color illustrations
(DOT-TSC-FAA-71-3) Avail: NTIS

A basic conceptual model of the entire air transportation system to serve as an analytical tool for studying the interactions among the system element is described. The model is designed to function in an interactive computer graphics environment which permits rapid alteration of rules and parameters, as well as continuous real-time graphical monitoring of system operations. The model described is the first member in an evolving hierarchy

of increasingly complex models, progressing in the direction of closer approximation to the real-world air transportation system.
Author

N72-20585# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF THE STATIONARY MOTIONS OF A SATELLITE WITH A GYROSCOPE IN A CENTRAL NEWTONIAN FIELD
R. S. Svlikashvili 10 Mar. 1971 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela (USSR), no. 6, 1971 p 3-6
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The stability of the steady state motions of a gyroscope mounted in Cardan suspension on a satellite is investigated. The axis of rotation of the outer ring of the gyroscope is directed along the radius vector of the center of mass of the system relative to the center of attraction and tangent to the orbit. The center of mass of the system is assumed to move in a circular orbit, and the angular velocity of the rotation of the gyroscope rotor is constant. The centers of mass of the satellite housing, the rotor and case, and the outer ring coincide. Author

N72-20586*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PASSIVE STABILITY OF A SPINNING SKYLAB
S. M. Seltzer 25 Feb. 1972 22 p refs
(NASA-TM-X-64646) Avail: NTIS CSCL 22B

The results of an analytical investigation of the rotational dynamics of a spinning Skylab space station are presented. The passive stability of motion of a simplified model consisting of a rigid core body with two attached flexible appendages is investigated. The parameter plane stability technique is applied to the specific Skylab case to determine its transient response to external disturbances. Author

N72-20587# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF STOL INSTRUMENT LANDING SYSTEM (TALAR 4) Final Report, Jul. 1970 - Jul. 1971
Glen D. Adams Apr. 1972 45 p
(FAA Proj. 320-114-05X)
(FAA-RD-72-15; FAA-NA-72-27) Avail: NTIS

The evaluation of two TALAR 4 systems for use on short takeoff and landing (STOL) tests is discussed. TALAR 4 operates at 15.5 GHz (Ku-band magnetron output), providing localizer and glide slope signals for approach guidance for aircraft equipped with a receiver. The units were modified to provide glide slope angles between 6 deg and 9 deg to include a transmitter monitor, and to transmit an identification code. The magnetron life is about 500 hours. The monitor is inadequate because of drift, but overall, the TALAR has been a reliable and useful tool. The guidance signals are generally of good quality. The transmitter location, in relation to the runway, affects the pilot's ability to set the aircraft down at the desired touchdown point. Author

N72-20588# European Space Research Organization, Paris (France).
SPACECRAFT OPERATIONS. VOLUME 4: ATTITUDE DYNAMICS
Dec. 1971 99 p refs Partly in ENGLISH and partly in FRENCH Proc. of the 8th ESRO Summer School, Neuisenburg, West Ger., Aug. 1970
(ESRO-SP-67) Avail: NTIS

A description of the theoretical grounds on which to establish the attitude prediction and determination of a spacecraft whether or not it is spin-stabilized. The main topics are illustrated with examples on French and European satellites. Goddard trajectory determination system, a large computer system for orbit and attitude determination, is described. Some scientific results relating to geodesy, the atmospheric forces, magnetic fields, and the radiation pressure are discussed. For individual titles, see N72-20589 through N72-20594.

N72-20589# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
RESTITUTION OF SATELLITE ATTITUDE [RESTITUTION D'ATTITUDE DE SATELLITES]
A. Comps *In* ESRO Spacecraft Operations, vol. 4 Dec. 1971 p 1-19 In FRENCH (See N72-20588 11-21)
Avail: NTIS

Principles and practical ways of achieving the restitution of satellite attitude are introduced. The mathematical formalism (mathematical model for the satellite motion, numerical analysis) is made precise. The results obtained for the FR-1, D-1A, and D-2A French satellites are shown. The problem of the automatic attitude control in Poinsot motion case is studied referring to the D-2 free flight mode. Author (ESRO)

N72-20590# European Space Operations Center, Darmstadt (West Germany).
DETERMINATION OF THE ATTITUDE OF A NON-SPIN-STABILIZED SATELLITE [DETERMINATION DE L'ATTITUDE D'UN SATELLITE NON STABILISE PAR ROTATION]
L. Fraiture *In* ESRO Spacecraft Operations, vol. 4 Dec. 1971 p 21-26 refs In FRENCH (See N72-20588 11-21)
Avail: NTIS

The attitude of nonspin-stabilized satellites was determined through a linear transfer from an inertial coordinate system to a spacecraft reference system. A method is shown for satellite rotation determination by the measurement of two spacecraft vectors. Author (ESRO)

N72-20591# European Space Operations Center, Darmstadt (West Germany).
GENERAL INTRODUCTION TO SPACECRAFT ATTITUDE DETERMINATION AND RELATED TOPICS
H. Kummer *In* ESRO Spacecraft Operations, vol. 4 Dec. 1971 p 27-34 refs (See N72-20588 11-21)
Avail: NTIS

Some basic principles such as the definition of the attitude, laws of angular motion, the methods for spacecraft stabilization, and the reference systems for attitude measurement are reviewed. A list and a brief description are given of the most frequently applied sensing systems. ESRO

N72-20592# European Space Operations Center, Darmstadt (West Germany).
ATTITUDE DETERMINATION FOR SPINNING SATELLITES
H. Kummer *In* ESRO Spacecraft Operations, vol. 4 Dec. 1971 p 35-44 (See N72-20588 11-21)
Avail: NTIS

The following points are examined: (1) differential correction methods for attitude determination, without reference to specific sensor systems and (2) various methods utilized for attitude data evaluation, using nonlinear and filter methods. The two cone intersection methods are also discussed, including near-earth satellites using magnetometers, sun sensors, and infrared sensors and far-earth satellites using sun sensors and different kinds of earth sensors. Star mappers and trackers are evaluated. Formulas are derived and applied to differential correction methods. A survey on attitude maneuvering methods is given, including the method used on ESRO satellites. Author (ESRO)

N72-20593# European Space Operations Center, Darmstadt (West Germany).
THE ATTITUDE RECONSTITUTION WORK FOR A SCIENTIFIC SATELLITE
H. Wassgren *In* ESRO Spacecraft Operations, vol. 4 Dec. 1971 p 45-53 (See N72-20588 11-21)
Avail: NTIS

An attitude determination problem for a scientific satellite during its lifetime is introduced; a practical solution adopted for HEOS-A2 satellite launched Dec. 1971 is given. The overall program towards attitude determination and prediction is reviewed

from the operational viewpoint, without mathematical details.
Author (ESRO)

N72-20594*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBIT AND ATTITUDE DYNAMICS AND THE GODDARD TRAJECTORY DETERMINATION SYSTEM
Joseph W. Siry *In* ESRO Spacecraft Operations, vol. 4 Dec. 1971 p 55-95 refs (See N72-20588 11-21)
(NASA-TM-X-67799) Avail: NTIS CSCL 22B

Orbit and attitude determination involve several types of functions, frequently performed with the aid of large, complex computer program systems such as the Goddard trajectory determination system. Results of studies connected with geodetic aspects of orbit determination, atmospheric drag perturbations, and the accuracy of spacecraft ephemerides are discussed. Attitude dynamics of spacecraft as they are affected by magnetic torques, radiation pressure, and atmospheric forces are considered. Some factors involved in the use of attitude sensor data are described. Author (ESRO)

N72-20595# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Systemanalysen.
AIR TRAFFIC PLANNING WITH METHODS OF LINEAR PROGRAMMING
Otto W. Pfeifer and Hartmut Wolff 1971 72 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-60) Avail: NTIS; DFVLR Porz: 16,50 DM

To give survey on various mathematical models for air traffic planning, those tasks were chosen and analyzed which yield linear set-ups. It was found that many of the air transportation problems may be represented as linear models, whereas comprehensive tasks such as the establishing of a real, optimum flight scheme cannot be treated purely linearly. In case of real problems, difficulties often occur with the numerical evaluation of the mathematical set-up to be optimized. Author

N72-20596# Litton Systems, Inc., Woodland Hills, Calif. Aero Products Div.
LIGHT EVALUATION OF INERTIAL/DME/DME MAP DISPLAY SYSTEM Final Report
R. J. Holm Aug. 1971 216 p refs
(Contract DOT-FA70WA-2379)
(AD-735015; FR-11; FAA-RD-71-46) Avail: NTIS CSCL 17/7

A map display driven by an INS/DME/DME navigation system was flown in a Convair 580 over the United States area for evaluation of map presentation, map film content, cockpit navigation use, ATC interface, and Area Nav in departure, enroute and approach operations. The map display was demonstrated and evaluated. Map film content included high altitude, low altitude, area charts, Jeppesen charts, R Nav, JNC topography plus VOR and ILS approach plates. GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-20597* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GASEOUS CONTROL SYSTEM FOR NUCLEAR REACTORS Patent
Edward Lantz and Harry W. Davison, inventors (to NASA) Issued 21 Dec. 1971 4 p Field 8 Aug. 1968
(NASA-Case-XLE-04599; US-Patent-3,629,068; US-Patent-Appl-SN-751215; US-Patent-Class-176-86G) Avail: US Patent Office CSCL 18I

An absorbing gas controlling system, which alters the reactivity of nuclear reactors with a minimum change in spatial distribution and neutron flux, is described. The system is also designed to minimize perturbations of power distribution; Control is obtained by varying the density of the neutron absorbing gas in the control tubes. E.H.W.

N72-20598*# Aerojet Nuclear Systems Co., Azusa, Calif.
NERVA MATERIALS DEVELOPMENT Quarterly Report, Jul. - Sep. 1970
B. Mandell Nov. 1970 195 p
(Contract SNP-1)
(NASA-CR-125889; QR-4; S131-PR04-W187F2E) Avail: NTIS CSCL 21F

Materials development topics include: development of analysis techniques to adjust heterogeneous data; determination of thermal conductivity for AISI 347 stainless steel and elastic moduli and Poisson's ratio for Inconel 718 and Ti 5Al-2.5Sn; embrittlement effects of 1400 psi gaseous hydrogen for alloy 718 and Ti 5Al-2.5Sn; cryogenic radiation damage of Ti 5Al-2.5Sn; and evaluation of prepreg, impregnation, and fabric materials for optimum fibrous graphite properties. Component support topics include: tensile design allowable development of Ti 5Al-2.5Sn for turbopump applications; evaluation of fatigue, fracture toughness, and stress corrosion properties of AA 7039-T63 for pressure vessel applications; development of AISI 347 sheet tensile and creep properties for nozzle applications; evaluation of orbital weld techniques for aluminum line fabrication; material selection of shield materials; development of high load friction and wear properties of hard chrome/gold plate combinations; and evaluation of weld processes for NASS duct coolant channel fabrication. Author

N72-20599# National Bureau of Standards, Washington, D.C. Reactor Radiation Div.
REACTOR RADIATION DIVISION Annual Progress Report, period ending 31 Oct. 1971
Robert S. Carter, ed. Mar. 1972 104 p refs
(NBS-TN-714) Avail: SOD $1.00 as C 13.46:714

The use of the National Bureau of Standard's high flux research reactor by the greater Washington scientific community and other government agencies or organizations is summarized. The reactor operates at 10 Mw and is designed to provide a broad spectrum of facilities ranging from intense neutron beams to extensive irradiation facilities. The summaries are divided into two sections: research activities and reactor operation and services. E.H.W.

N72-20600*# Scientific Translation Service, Santa Barbara, Calif.
ON THE THEORY OF CAVITY REACTORS WITH COMPRESSIBLE FUEL. 2: DYNAMIC REACTIVITY DEPENDENCE ON SYSTEM PARAMETERS
V. L. Blinkin and V. M. Novikov Washington NASA Mar. 1972 33 p refs Transl. into ENGLISH of "K Teorii Polostnykh Reaktorov so Szhimayemym Toryuchim. 2: Zavisimost' Dinamicheskoy Reaktivnosti Otparametrov Sistemy", Rept. AIE-2140 Inst. At. Energii, Moscow, 1971 20 p
(Contract NASw-2035)
(NASA-TT-F-14224; IAE-2140) Avail: NTIS CSCL 18I

The influence of fuel density oscillations in the core of an externally moderated reactor upon reactor dynamics investigated. Centrally symmetric oscillations (in a spherical reactor), axisymmetric acoustic oscillations (in a cylindrical reactor), and oscillations along the axis of a plane reactor, as well as complete fuel mass oscillations, in which the fuel density varies simultaneously throughout the core volume, are considered. Dependence of the sign and magnitude of the dynamic reactivity on the type of fuel density oscillations, moderator parameters, and system geometry were investigated. It is shown that the relative amplitude of the neutron flux oscillations may be greater than that of the fuel density oscillations. Author

N72-20601*# Scientific Translation Service, Santa Barbara, Calif.
ON THE THEORY OF CAVITY REACTORS WITH COMPRESSIBLE FUEL. 1: DYNAMIC CHARACTERISTICS IN THE CASE OF FUEL DENSITY OSCILLATIONS
V. M. Novikov and V. L. Blinkin Washington NASA Mar. 1972 29 p refs Transl. into ENGLISH from "K Teorii Polostnykh Reaktorov so Szhimayemym Goryuchim. 1: Dinamicheskiye Kharaketeristiki pri Kolebaniyakh Plotnosti Goryuchevo", Inst. Atomnoy Energii Moscow, report IAE-2139
(Contract NASw-2035)
(NASA-TT-F-14223; IAE-2139) Avail: NTIS CSCL 18K

Influence of fuel density oscillations in the core of an externally moderated reactor on reactor dynamics is investigated. The problem is formulated in the age diffusion approximation by application of effective boundary conditions. For solution of this problem an adiabatic perturbation theory for the nonselfadjoint equation is developed. It is shown that additional reactivity emerges due to the density oscillations. Author

N72-20602*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ION EXCHANGE NUCLEAR REACTOR Patent Application
John L. Power, inventor (to NASA) Filed 29 Nov. 1971 27 p
(NASA-Case-LEW-11645-1; US-Patent-Appl-SN-202806) Avail: NTIS CSCL 18I

A fuel system for a thermal nuclear reactor is described which utilizes an inorganic ion exchanger to retain nuclear fuel in the reactor core. A circulating aqueous solution supplies the fuel to the ion exchanger, removes the fuel from the ion exchanger, acts as a moderator, effects control of the reactor power, and removes deleterious products from the reactor core portion of the fuel system. NASA

N72-20603# Aktiebolaget Atomenergi, Studsvik (Sweden).
URANIUM MARKET
1971 30 p refs In SWEDISH
(NP-19069; AES-8) Avail: AEC Depository Libraries

The demand for uranium for use in nuclear power stations is projected to 1985 for the western world. The resources of uranium in western countries and the prospecting efforts are described. Present and future prices of uranium oxides are surveyed. NSA

N72-20604# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Sep. 1971
26 Oct. 1971 169 p refs
(Contract W-31-109-eng-38)
(ANL-7861) Avail: NTIS

Highlights of project activities for September 1971 are summarized. The Experimental Breeder Reactor-2 operations, fuels and materials studies, and engineering development are reported. Heat transfer and fluid flow in LMFBR cores were studied. The development of instrumentation for sodium cooled reactors was continued. Sodium monitoring and sampling systems for the Fast Flux Test Facility and LMFBR systems are described. LMFBR fuels and materials development and fuel cycle studies are examined. Zero power reactor fast critical experiments and LMFBR safety studies are summarized. Thermal plume dispersion and power plant siting on Lake Michigan were studied. NSA

N72-20605# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Edutes Nucleaired.
MICROANALYSIS BY NUCLEAR REACTIONS. APPLICATION TO SEMICONDUCTORS [MICRO-ANALYSE PAR REACTIONS NUCLEAIRES APPLICATION AUX SEMI-CONDUCTEUR]
Andre Bontemps, Joel Monnier, and Michel Bruel Aug. 1971 11 p refs In FRENCH Presented at 2d Intern. Symp. on the Appl. of Vacuum Tech. in Semiconductor Ind., Electron. Components and Micro-Electron., AVISEM 71, Versailles, France, 13-17 Sep. 1971
(CEA-CONF-1852; Conf-710932-1) Avail: AEC Depository Libraries

The distribution of the B impurities between the Si and SiO2 of a B-doped Si substrate was studied during the oxidation of the substrate. The microanalysis was performed using nuclear reactions; a mathematical diffusion model was subsequently developed. The diffusion process was studied for different diameter samples, and as a function of certain fabrication parameters. The gas-oxide-silicon exchanges, and the parameters intervening in the DIFFUSI program were studied; this program deals with all the phenomena occurring in the fabrication of planar transistors. NSA

N72-20606# Los Alamos Scientific Lab., N.Mex.
RADIATION ENVIRONMENT OF REACTORS FOR NUCLEAR ROCKET PROPULSION
Glen A. Graves [1971] 13 p Sponsored by AEC
(TID-24860; N-2-560) Avail: NTIS

Results of systems studies on nuclear rocket propulsion show that reactors for this purpose are likely to have very high power levels, very high power densities, and thin shields. The integrated dose from such radiation sources will be comparable to any now confronting the ANP Program, but the dose rates will be orders higher. These problems are discussed as they relate to some reactors under consideration at LASL.
Author (NSA)

N72-20607# Argonne National Lab., Ill.
PROCEEDINGS OF THE 12TH ANNUAL AUA-ANL NUCLEAR ENGINEERING EDUCATION CONFERENCE
John Bradish, ed. 1971 215 p refs Conf. held at Argonne, Ill., 1-2 Feb. 1971
(Conf-710218) Avail: NTIS

Papers and discussions presented at the conference concerned the university's role in public understanding of nuclear power. Problems in informing the general public on the social, economic, and environmental impact of nuclear power plant construction and operation are examined. The need to educate the public on all technical aspects of nuclear power so that the public can make the decisions regarding possible applications is stressed. NSA

N72-20608# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NUCLEAR FUEL SIMULATION BY ELECTRICAL HEATERS
Andre Teytu Aug. 1971 21 p refs In FRENCH
(CEA-R-4210) Avail: AEC Depository Libraries

The use of electric heaters as simulators in heat transfer experiments is described. The different heaters are enumerated. The constructions and technical solutions adopted in their design are discussed. The fuel elements simulated were those of swimming pool reactors, water reactors (boiling and pressurized), organic liquid cooled reactors, and fast reactors. Author (NSA)

N72-20609# Oak Ridge National Lab., Tenn.
FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, period ending 30 June 1971
P. Patriarca Sep. 1971 146 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3540) Avail: NTIS

Research and development is reported on fast breeder reactor fuels, advanced fast breeder reactor fuels, fuel cladding and reactor structural materials, welding techniques for stainless steel reactor components, corrosion of reactor materials, nondestructive test methods for reactor materials, neutron absorber materials, materials for isotopic power programs, properties of refractory metals and alloys, tungsten metallurgy, and radiation effects on reactor metals. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-20610 British Broadcasting Corp., Kingswood (England).
ACOUSTIC SCALING: AN EVALUATION OF THE PROVING EXPERIMENT
H. D. Harwood, A. N. Burd, and N. F. Spring 1972 10 p refs
(BBC-1972/3; PH-84) Avail: BBC Kingswood Warren, Tadworth, Surrey, England

A model of Studio 1, Maida Vale, was constructed at one-eighth scale. Measurements involved in the selection of the materials to be used in the building and furnishing of the model are described, and an account is given of both the objective and subjective results obtained using the model. The results indicate that the modeling technique provides a useful tool for assessing the microphone sound quality that would be obtained from a full-size studio. Author

N72-20611# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF THE MUTUAL INFLUENCE OF PARAMETERS IN A CRYOGENIC SYSTEM BY THE METHOD OF SMALL DEVIATIONS
V. N. Novotelnov 1972 5 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no 1, 1972 p 83-87
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The mutual influence of parameters in a single stage, gas expansion system is examined. The method of small deviations is applied. The results of the solution of the system of equations is presented as a table of the coefficients of mutual influence, and use of the table is illustrated by a numerical example. Author

N72-20612*# Radio Corp. of America, Princeton, N.J.
ELECTRONICALLY TUNED OPTICAL FILTERS
Joseph A. Castellano, Edward F. Pasierb, Chan S. Oh, and Michael T. McCaffrey Jan. 1972 48 p refs
(Contract NAS1-10490)
(NASA-CR-112032; PRRL-72-CR-3) Avail: NTIS CSCL 20F

A detailed account is given of efforts to develop a three layer, polychromic filter that can be tuned electronically. The operation of the filter is based on the cooperative alignment of pleochroic dye molecules by nematic liquid crystals activated by electric fields. This orientation produces changes in the optical density of the material and thus changes in the color of light transmitted through the medium. In addition, attempts to improve materials and devices which employ field induced changes of a cholesteric to a nematic liquid crystal are presented. Author

N72-20613# Oslo Univ. (Norway). Inst. of Physics.
POLYNOMIAL APPROXIMATIONS TO THE STARK PERTURBED ROTATIONAL ENERGY LEVELS OF THE RIGID SYMMETRIC TOP ROTOR
I. Roeggen [1972] 20 p refs
Avail: NTIS

The reduced energy levels of the rigid symmetric top rotor under the influence of an external, static, electrical field are obtained as polynomials in the Stark parameter lambda. Expansion coefficients are given for the case of magnetic quantum numbers absolute K,M < or = 4, and for all rotational states through J = 7. For K or M different from zero, the approximations are valid for absolute lambda < or = 10, and when K = M = 0 for absolute lambda < or = 3. Author

N72-20614*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIMENTAL INVESTIGATIONS OF THE ACOUSTIC REFLECTION COEFFICIENT OF DISCONTINUOUS CHANGES OF CROSS SECTION IN TUBES WITH AIR FLOW
D. Ronneberger Washington NASA Mar. 1972 34 p refs Transl. into ENGLISH from Acustica (Stuttgart), v. 19, 1967-1968 p 222-235
(Contract NASw-2035)
(NASA-TT-F-14222) Avail: NTIS CSCL 20A

The air flow in the region of a change of cross section is quasi-stationary at low frequencies. In this case the influence of flow velocity on the reflection coefficient of this change in cross section can be explained by the differential flow resistance. The change of the reflection coefficient is calculated in the same manner as Powell treated continuous changes of the cross section. With increasing frequency, the influence of the pressure gradient behind the change of cross section on the reflection coefficient becomes less and less important. It is demonstrated for the example of an expansion of the cross section that at high frequencies annular vortices are separated from the cross-sectional jump in synchronism with the sound signal. These vortices produce an alternating pressure which affects the impedance of the cross-sectional jump and hence its coefficient of reflection. Author

N72-20615*# Scientific Translation Service, Santa Barbara, Calif.
EVAPORATION FROM A LIQUID SURFACE UNDER A HIGH AND A MEDIUM VACUUM
U. Hajime, K. Toshiki, and Y. Osamu Washington NASA Apr. 1972 21 p refs Transl. into ENGLISH from Kagaku Kogaku (Japan), V. 24, no. 5, 1960 p 274-280
(Contract NASw-2035)
(NASA-TT-F-14193) Avail: NTIS CSCL 20D

Observations on evaporation from liquid surface under a high and a medium vacuum revealed the existence of two new surface phenomena, icefield-torpid surface and concave-evaporating surface. Measurements of the effect of vapor pressure and of the inert gas on the evaporation rate served to clarify the mechanism of mass transfer in an evaporating space. The following conclusions are drawn: (1) Molecular evaporation consists of two mechanisms; molecular-projective-evaporation, where the vapor molecules pass relatively freely through the inert gas, and molecular-burst-evaporation, where the escaping vapor pushes the inert gas along before it. (2) Mass transfer in the evaporating space under a medium vacuum is understood as a slip-diffusion, when the rate does not reach the maximum. Author

N72-20616# Institut Atomnoi Energii, Moscow (USSR).
STABILITY OF SINGLE-TURN COILS IN PULSED MAGNETIC FIELDS UP TO MGs
A. M. Andrianov, V. F. Demichev, G. A. Eliseev, and P. A. Levit 1970 10 p refs
(IAE-2025) Avail: AEC Depository Libraries

Copper, beryllium, and chromium bronzes, various steels, niobium, molybdenum, tantalum, tungsten, and some other metals were used as coil materials. A 58-kJ capacitor bank of low inductance was used as a current source. Preliminary estimates of the stability of coil materials were based on their dynamic and thermal characteristics. In particular, the impact strength and the critical speed of impact of the materials were taken into account. The stability criteria obtained are in qualitative agreement with the experimental results of the study of the behavior of the materials in strong pulsed magnetic fields. Tantalum is the most stable of all the materials tested. Tantalum coils can be used for repeated production of pulsed magnetic fields as high as 1 MG. Tantalum also shows itself to be the best material for generating stronger fields in short coils. Author (NSA)

N72-20617# Akademiya Nauk SSSR, Novosibirsk. Inst. Yadernoi Fiziki.
IRONLESS AND IRON-CONDUCTOR MAGNETS AND LENSES WITH THICK WINDINGS FOR ACCELERATORS
V. G. Davidovskii 1970 104 p refs In RUSSIAN; ENGLISH summary
(IYAF-40-70) Avail: AEC Depository Libraries

Formation of stationary two-dimensional magnetic fields by ironless and iron-conductor magnets and lenses with windings of arbitrary thickness which tightly surround the domain of formation is considered. For magnets and lenses with circular and elliptical domain, analytical expressions for magnetic fields in metal windings are found. Numerical solution of boundary equations at the outer boundary of windings allows one to define the shape of the boundary. The cases of ironless magnets and lenses and iron-conductor ones are considered. the method is applied to calculations of ironless and iron-conductor magnets and lenses with circular domain. The results of numerical calculations of the shapes of the windings of various thickness and energy distributions are given for the cases of dipole and quadrupole magnets and lenses as well as for constant gradient field magnets. Author (NSA)

N72-20618# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnickeskii Inst.
RESONANCE PHENOMENA IN CONFIGURATIONS WITH HELICAL MAGNETIC AXES WHEN CALCULATING TOROIDALITY, 2
V. F. Aleksin, V. V. Nemov, and A. A. Shishkin 1971 12 p refs In RUSSIAN
(KHFTI-71-13) Avail: AEC Depository Libraries

The domain of exact resonance and the approaches to this domain from the area of nonresonance are explored. The possibility of complicating the magnetic structure during detuning of some characteristic frequency from its resonance value is discussed. Author (NSA)

N72-20619# Joint Inst. for Nuclear Research, Dubna (USSR).
HIGH-FREQUENCY DISCHARGE IN A COAXIAL RESONATOR WITH AN EXTERNAL MAGNETIC FIELD
G. A. Ivanov and E. G. Gavrilova 1971 22 p refs In RUSSIAN
(JINR-P9-5853) Avail: AEC Depository Libraries

Conditions for the development of single electrode high-frequency discharges are investigated. For specific loss stipulations resulting from the discharges, the magnitude and control of the fundamental secondary emission coefficients and frequency ratio (omega sub zero/omega) are shown, where (omega sub zero/omega) = (eH/mc) and omega is the angular velocity of HF fields. Author (NSA)

N72-20620# United Kingdom Atomic Energy Authority, Harwell (England).
STUDY OF THE INFLUENCE OF A MAGNETIC FIELD ON THE BEHAVIOUR OF ELECTROSTATIC SEPARATORS
D. J. Simon and R. Michelier Jul. 1970 30 p refs Transl. into ENGLISH from CERN report MPS/Int-MU/SD-69-1
(LB/G-2977; MPS/Int-MU/SD-69-1) Avail: AEC Depository Libraries

Limitations imposed on operation of electrostatic separators by the simultaneous presence of electric and magnetic fields were evaluated. It was found that such conditions cause a reduction of the limiting upper vacuum pressure for the system; this is considered a negligible factor in practice. Another result of the presence of these two fields is the appearance of a critical pressure above which any sparking which occurs in the separator is followed by a sustained discharge. Temporary removal of the magnetic field overcomes this unwanted reaction. NSA

N72-20621# United Kingdom Atomic Energy Authority, Culham (England).
HELICAL MAGNETIC CONFIGURATIONS WITH MINIMUM AVERAGE B
N. M. Zueva Aug. 1971 18 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Inst. Prikl. Mat., Moscow, report
(CTO-766) Avail: AEC Depository Libraries

One class of helical fields is examined and their structure is elucidated. Fields having a magnetic well on the axis are analyzed in detail. Author (NSA)

N72-20622# California Univ., Livermore. Lawrence Radiation Lab.
DESIGN CRITERIA FOR ACOUSTIC EMISSION EXPERIMENTATION
C. A. Tatro 15 Jun. 1971 29 p refs Presented at the Conf. on Acoustic Emission, Bal Harbour, Fla., 7 Dec. 1971 Sponsored by AEC
(UCRL-73230; Conf-711201-3) Avail: NTIS

Acoustic emission experiments that can be performed in the laboratory using a single transducer and involving specimens or simple components are discussed. The emphasis is on experimental design rather than on single experiments or results therefrom. The experiments described are restricted to those where application of mechanical load is used to condition the material, and where commercially available equipment is adequate for instrumentation. The magnitudes and characteristics of the acoustic emission response are described. The compromises in signal detection and data acquisition methods follow from this description. Those aspects of experimental design which are most likely to be foreign to the new user of acoustic emission techniques are pointed out, as are ways to assure that a proper design has been achieved. Results of an experiment which reveals the unique power of acoustic emission technology to reveal subtle changes in material are given as an example.
Author

N72-20623# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
STRUCTURE OF A WAVE-FUNCTION AND WAVE MODEL OF THE WORLD
S. N. Sokolov 1970 37 p refs
(IFVE-SVM-70-54) Avail: AEC Depository Libraries

A mechanism of irreversible changes in wave functions was studied, and wave structures were considered. The usual nonrelativistic quantum mechanics of many-body systems was used. Wave mechanics was built up from a purely wave point of view on the bases of notions defined through the wave functions, and the difference of the new picture from the usual one is discussed. NSA

N72-20624# Joint Publications Research Service, Washington, D.C.
TRANSPORT PROCESSES IN TOROIDAL MAGNETIC TRAPS. 1: INITIAL EQUATIONS
L. M. Kovrizhnykn AEC [1971] 32 p refs Transl. into ENGLISH from the Russian report NP-18340
(AEC-tr-7284; NP-18340) Avail: NTIS

The first part of a theoretical analysis of the problem of collisional diffusion in closed magnetic traps is presented. It includes the systematic derivation of basic equations for construction of the theory of transport processes in toroidal systems having complex magnetic-field geometry, specifically, the derivation of drift kinetic equations, expressions for particle and energy fluxes, collision integrals, and general relations necessary for future analysis of transport processes.
Author (NSA)

N72-20625# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
NEMATIC LIQUID CRYSTALS [CRISTAUX LIGUIDES NEMATIQUES]
M. Hareng Oct. 1970 60 p refs In FRENCH
(LCR-70-190/1/R) Avail: NTIS

The characteristics of nematic liquid crystals and their

application to display devices are discussed. The main parameters that influence the performances are analyzed including applied voltage, wavelength of the incoming light, temperature, nature of the crystal and of the additives and the form of the cells. For each of these parameters the scattered flux and the ratio scattered flux with and without electric voltage are given. The response time of the crystals as function of the parameters is also discussed. ESRO

N72-20626# Rome Univ. (Italy). Inst. of Physics.
G-L BEHAVIOUR OF TWO DIMENSIONAL Al FILMS BELOW T SUB C
M. Cerdonio, T. DiLeo (Selenia, Rome), and G. Lucano 25 Feb. 1971 8 p refs Sponsored by CNR
(Nota-Interna-305) Avail: NTIS

The temperature dependence of fluxoid of critical current was measured near the critical temperature for thin aluminum hollow cylinders using flux trapping techniques. Agreements with Ginsburg-Landau theory is found despite two-dimensional experimental conditions. ESRO

N72-20627# Institut Franco-Allemand de Recherches, St. Louis (France).
NUMERICAL AND EXPERIMENTAL INVESTIGATION OF LIGHT DIFFRACTION IN PLANE SHOCK WAVES [NUMERISCHE UND EXPERIMENTELLE UNTERSUCHUNG DER LICHTBEUGUNG AN EBENEN STOSSWELLEN]
H. J. Pfeifer, H. D. vomStein, and B. Koch Bonn Bundeswehramt 1971 19 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVG-FBWT-71-30) Avail: NTIS; Bundeswehramt Bonn: 25 DM

A simple numerical procedure is described for calculating diffraction patterns of all one-dimensional objects, in which the wave used to illuminate the object shows an arbitary but defined distribution of amplitude and phase. In this procedure, Kirchhoff's method was substituted by direct summation of many elementary waves. By applying the technique to shadow and schlieren photography, it is possible to determine the magnitude of the refraction index jump from the intensity profile. Author (ESRO)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-20628 National Lending Library for Science and Technology, Boston Spa (England).
REQUIREMENTS FOR THE IMAGING OF CARBON ATOMS IN BIOMOLECULES
O. Scherzer [1971] 37 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 33, no. 5, 1971 p 501-516 In German and ENGLISH
(NLL-M-22059-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Preliminary experiments were conducted to check the possibility of developing an electron microscope system which would render the individual carbon atoms in biomolecules visible. The optical, mechanical, and regulation technique requirements for such a system are discussed. K.P.D.

N72-20629*# Pittsburgh Univ., Pa. Dept. of Physics.
EXCITATION OF THE METASTABLE E(3 SIGMA g PLUS) STATE OF N2 BY ELECTRON IMPACT
W. L. Borst (Southern Illinois Univ., Carbondale), W. C. Wells, and E. C. Zipf Jan. 1972 15 p refs
(Grant NGL-39-011-030)
(NASA-CR-125822; SRCC-163) Avail: NTIS CSCL 20H

The contribution of the N2(E(3 Sigma g plus)) state to the total metastable excitation function of N2 assessed on the basis of time-of-flight studies of metastable nitrogen molecules. The cross section for electron impact excitation state was determined in the domain of the resonance form threshold (11.87 eV) to an energy of about 13 eV. The maximum value of the cross section was found to be (7.0 + or - 4.0) x 10 to the -18th power sq cm at an energy of 12.2 eV. The measurement was made absolute by using the previously determined yield of the metastable detector, the lifetime of the E state, and by eliminating the energy spread in the electron beam from the raw data. The half-width (FWHM) of the resonance-like excitation function near threshold was found to be about 0.4 eV. No substantial evidence was obtained from the present data for the presence of the nonresonant part of the excitation function for the state studied. Author

N72-20630# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
FREQUENCY SHIFTS DUE TO RAMSEY TYPE INTERROGATION IN ATOMIC BEAM TUBES
Helmut Hellwig, J. A. Barnes, D. J. Glaze, and Peter Kartaschoff (Lab. Suisse de Rech. Horlogeres) Feb. 1972 27 p refs
(NBS-TN-612) Avail: SOD $0.35 as C13.46.612

A phase difference between the two interaction regions of a Ramsey excitation resonance structure results in a frequency bias in the measured beam resonance. A simple mathematical model is discussed which describes the dependence of this bias on the phase difference, the microwave power level, the modulation amplitude, and the resonance linewidth. In a first order approximation, no dependency on the frequency modulation amplitude is expected. Near-linear dependencies on the linewidth and microwave power level which are quite pronounced even at relatively small cavity phase differences are predicted. The theoretical results are compared with one set of experimental data on the microwave power dependence. After a correction is applied to remove the power dependence due to spectral impurity of the microwave excitation, the remaining measured power dependence agrees quantitatively with that calculated using a cavity phase difference of about 3 milliradians. One of the most serious effects limiting the accuracy of atomic beam resonators is the uncertainty of phase shifts between the oscillating fields in a Ramsey excitation cavity. A technique using the linewidth dependence on the excitation power to measure the phase-shift induced bias proposed. The conditions under which this method is valid and their implications on the design of beam optics are discussed with consideration of available experimental results. Author

N72-20631*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESONANCE, PARTICLE TRAPPING, AND LANDAU DAMPING IN FINITE AMPLITUDE OBLIQUELY PROPAGATING WAVES
P. J. Palmadesso Mar. 1972 640 p refs
(NASA-TM-X-65852; X-641-72-75) Avail: NTIS CSCL 20H

The equations of motion for a particle in resonance with a small finite amplitude wave are solved approximately, using secularity free perturbation theory. The wave propagates at an arbitrary angle to a uniform background magnetic field in an infinite collisionless plasma. The wave fields include a longitudinal electrostatic component and elliptically polarized transverse electric and magnetic components. The trajectories of trapped and resonant untrapped particles are described, for each of the possible wave-particle resonances. These trajectories are used to construct an estimate of the nonlinear time dependent Landau damping rate of the wave. Author

N72-20632# Technische Hochschule Munchen (West Germany).
ELECTRON PHOTOEMISSION FROM ADDITIVE ELECTRONS IN ELECTROLYTE SOLUTION Ph.D. Thesis

[PHOTOEMISSION VON ELEKTRONEN AUS ELEKTRONEN-DONATOREN IN ELEKTROLYTLOESUNG]
Juergen Kinder 1971 58 p refs In GERMAN
Avail: NTIS

The photoeffect caused by the electron emission from aqueous solutions of mixed dyes and inorganic salts, as well as the ionization energy, were determined. A light source in the far ultraviolet region was used to produce reduced intensity radiation. The method of conducting the analysis of samples of the mixture is described. It is shown that the value of the photoelectric current essentially depends on the concentration of the substance on the phase interface and on the surface activity.
Transl. by P.N.F.

N72-20633# Technische Univ., Berlin (West Germany).
ON THE LUMINESCENCE OF THE Mn2(PLUS) CENTER IN ZnS Ph.D. Thesis [ZUR LUMINESZENZ DES Mn2(PLUS)-ZENTRUMS IM ZnS]
Eberhard Neumann 1971 183 p refs In GERMAN
Avail: NTIS

The optical properties of an interference center in zinc sulfide as caused by the insertion of a manganese ion on a zinc ion base are discussed. The reaction of these interference centers with the energy bands of zinc sulfide are examined. The influence of antiferromagnetic reactions between neighboring manganese ions on the optical properties of the centers is investigated. Mathematical models and graphs are presented to support the theoretical analysis.
Transl. by P.N.F.

N72-20634# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
POSSIBLE BEHAVIOUR OF REGGE TRAJECTORIES IN VENEZIANO-LIKE REPRESENTATIONS
Masanori Kobayashi Jan. 1972 12 p refs
(RIFP-140) Avail: NTIS

Canonical product representations for scattering amplitudes which possess meromorphy in s and t, as well as Regge behavior, were investigated in terms of entire functions of order rho. The representation turned out to be of order either rho=1 or rho=0. The case of rho=1 corresponds to the Veneziano representation, and the case of rho=0 to the Coon representation, which has logarithmic trajectories and polynomial residues of order n in s(t) at the n-th pole in t(s).
Author

N72-20635# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
MODEL FOR ELASTIC SCATTERING AND THE ISR DATA
V. V. Ilyin (Inst. for Theoret. Phys., Kiev.), L. L. Jenkovszky (Inst. for Theoret. Phys., Kiev.), N. A. Kobylinsky (Inst. for Theoret Phys., Kiev), and V. P. Shelest Jan. 1972 23 p refs
(RIFP-139) Avail: NTIS

A description of the total and differential cross sections of elastic proton-proton scattering is presented, based on a model for a dual vacuum trajectory. It is compatible with ISR data, which indicate the flattening of the diffraction slope.
Author

N72-20636# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
THE ELECTROMAGNETIC FORM FACTORS BASED ON THE THEORY OF MEROMORPHIC FUNCTIONS
Masanori Kobayashi Jan. 1972 23 p refs
(RIFP-137) Avail: NTIS

The electromagnetic form factors (EMFF) are investigated by taking into account an infinite set of vector mesons which appear on the daughter trajectories. A general form of EMFF follows from the Hadamard theorem on a meromorphic function of order rho. The Veneziano-type EMFF is a meromorphic function of order one. A second form for the EMFF is also found which has the same asymptotic behaviour as the Veneziano-type EMFF. It is shown that physically acceptable orders are either $1/2 < \text{or} = \text{rho} < \text{or} = 1$, or rho = 0. Asymptotic n-power (n=integer) behavior is possible only if rho = 0.
Author

N72-20637*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION HARDENING OF MOS DEVICES BY BORON Patent Application
Vitaly Danchenko, inventor (to NASA) Filed 9 Dec. 1971 16 p (NASA-Case-GSC-11425-1; US-Patent-Appl-SN-206266) Avail: NTIS CSCL 18F

A technique is described for stabilizing the gate threshold potential at room temperature of a radiation-subjected MOS field effect device. The device is of the type having a semiconductor substrate, an insulating layer of oxide on the substrate, and a gate electrode disposed on the insulating layer. Boron is introduced into the insulating oxide, within a layer of the oxide of about 100 A to 300 A thickness immediately adjacent the semiconductor-insulator interface. The concentration of boron in the oxide layer is preferably maintained on the order of 10 to the 18th power atoms/cc. The technique serves to reduce and annihilate radiation-induced positive gate charge accumulations, which, if not eliminated, would cause shifting of the gate threshold potential of the MOS device, and render it unstable and/or inoperative.
NASA

N72-20638# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
DUAL AMPLITUDES AND THE THIRRING MODEL
I. Andric and J. L. Gervais Dec. 1971 19 p refs
(LPTHE-71/59) Avail: NTIS

Dual models can be constructed from any two dimensional, conformal invariant field model. This construction is carried out for the case of the Thirring model.
Author

N72-20639# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
RADIAL DISTRIBUTION FUNCTIONS FOR INVERSE-12 (SOFT SPHERE) FLUIDS
J. P. Hansen and J. J. Weis Jan. 1972 18 p refs Prepared in cooperation with the Centre Natl. de la Rech. Sci.
(LPTHE-72/1) Avail: NTIS

Radial distribution functions, from computer experiments on a classical fluid of particles interacting through an inverse 12th power potential, are tabulated over an extended range of values of the parameter x=1(fourth root of temperature times volume), which completely defines the thermodynamic state of the system. A comparison of these exact results is made with high-temperature data for the Lennard-Jones fluid and with perturbation theoretical predictions.
Author

N72-20640# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
AN ANOMALY-FREE VERSION OF WEINBERG'S MODEL
C. Bouchiat, J. Tliopoulos, and Ph. Meyer Jan. 1972 14 p refs
(LPTHE-72/4) Avail: NTIS

The difficulties of carrying the renormalization program in a theory containing Adler anomalies are discussed. Some models of weak and electromagnetic interactions, involving both lepton and quark fields, in which the troublesome anomalies cancel are presented.
Author

N72-20641# Kyoto Univ. (Japan). Research Inst. of Fundamental Physics.
ON THE TRIPLE-REGGE AMPLITUDE
Yoichi Iwasaki and Shigeo Yazaki Jan. 1972 12 p refs Sponsored in part by Sakkokai Foundation
(RIFP-141) Avail: NTIS

The tri-Regge amplitude was found to be composed of two parts. One has the ordinary tripler Regge behavior, with a factor which is a generalization of the nonsense zeroes; the other has single Regge behavior.
Author

N72-20642# Northeastern Univ., Boston, Mass. Dept. of Physics.
ALGEBRAIC TECHNIQUE FOR THE TRANSPORT AND

OPTICAL PROPERTIES OF ELECTRONS IN A RANDOM ARRAY OF STRONG SCATTERING CENTERS
James L. Sigel Jan. 1972 24 p refs
(NUB-2112) Avail: NTIS

An algebraic technique is developed for the evaluation of the coefficients of a general transport equation for dynamically independent electrons in the presence of random impurities. The method readily yields coefficients in powers of the impurity density for arbitrarily strong single center potentials. There is no restriction on the wave vector or frequency of the external electric field. The coefficients of the transport equation are given explicitly up to first order in the impurity density and the case of free electrons is studied in detail. For short range scatterers, a closed expression for the transverse conductivity is obtained.
Author

N72-20643# Illinois Univ., Urbana. Dept. of Physics.
COMMENT ON THE DEPENDENCE OF INCLUSIVE CROSS SECTIONS ON MISSING MASS SQUARED
J. Randa [1972] 9 p refs
(Grant NSF GP-25303)
(ILL-(TH)-72-6) Avail: NTIS

A certain class of one-particle inclusive reactions have differential cross sections which are predicted to rise as a function of missing mass squared. Data for one such reaction now exist and other reactions in which this effect should be observed are suggested.
Author

N72-20644# Democritus Nuclear Research Center, Athens (Greece).
PHYSICS DEPARTMENT Annual Report, 1970
1971 109 p refs
(DEMO-71/3) Avail: AEC Depository Libraries

A review of research conducted during 1970 is presented. Topics investigated include: (1) radiation effects on aluminum, copper, silver, and alloys; (2) elementary particles, meson-pion interactions, and nucleon studies; (3) plasma wave phenomena; and (4) axiomatic approach to quantum mechanics.
K.P.D.

N72-20645# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
WENTZEL-KRAMERS-BRILLOUIN METHOD FOR CALCULATING THE AMPLITUDE OF HIGH ENERGY SCATTERING BY CONTINUOUS POTENTIALS
V. N. Pervushin 1971 25 p refs In RUSSIAN
(JINR-P2-5990) Avail: AEC Depository Libraries

The quasiclassical method of Wentzel-Kramers-Brillouin was used to compute the particle scattering amplitude at continuous potentials. The qualitative description of the quasiclassical interaction is stressed as applied to dynamic and kinematic scattering parameters. Attention is also focussed on the physical interpretation of results from the point of view of classical principles.
Author (NSA)

N72-20646# Aktiebolaget Atomenergi, Studsvik (Sweden).
DEVELOPMENT OF COMPUTER-BASED SYSTEMS USED FOR NUCLEAR MEASUREMENT
J. Bjoerkman and P. G. Sjoelin Jun. 1971 12 p refs In SWEDISH
(STU-69-198/U-126) Avail: AEC Depository Libraries

The use of on-line computers for nuclear measurements is described. Special attention is given to the use of gamma radiation detectors of the Ge(Li)-type as the information source. A survey of the market for minicomputers was made. The different possibilities for transmission of the analog signal from the detector to the digital storage in the computer memory are described. The program for the computer includes routines for showing an arbitrary part of the spectrum on a memory oscilloscope. Communication between operator and computer is facilitated with a so-called joystick. A manual for handling the system is included.
NSA

N72-20647# Helsinki Univ. (Finland). Dept. of Nuclear Physics.
EXCHANGE MECHANISMS IN THREE BODY K(+) p COLLISIONS
Jorma Tuominiemi 1970 14 p refs
(NP-19052) Avail: AEC Depository Libraries

Some three-body K(+) + p interactions mainly at 5 and 8.25 GeV/c are reviewed in terms of different exchange models. Some aspects of the exchange mechanisms are tested. It is found that peripherality is a dominating feature in these reactions and also the strong production of K* and N* production.
NSA

N72-20648# Addis Translations International, Woodside, Calif.
POSITRON-ELECTRON AND ELECTRON-ELECTRON STORAGE-RING EXPERIMENTS
D. Schildknecht, H. J. Willutzki, and G. Wolf [1971] 71 p refs Transl. into ENGLISH of "Experimente am Positron-Electron und Electron-Electron Speicherring", Rept. DESY-71/28 Deut. Elektronen-Synchrotron, Hamburg, Jun. 1971 p 144 Prepared for Stanford Linear Accelerator Center Sponsored by AEC
(SLAC-Trans-135; DESY-71/28) Avail: NTIS

The summary covers theoretical aspects and estimates of effective cross sections and counting rates. The verification of quantum electrodynamics, hadron production through one-photon and electron exchange, and weak interaction experiments are discussed.
NSA

N72-20649# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
CONTRIBUTION TO THE SELECTION OF RADIOACTIVE TRACERS FOR HYDROLOGY
A. Lallemand and G. Grison 1970 12 p Transl. into ENGLISH of EURATOM report Presented at Symp. on the Use of Isotopes in Hydrology, Vienna, 9-13 Mar. 1970
(LIB/Trans-298; Conf-700328-3; SM-129/52) Avail: AEC Depository Libraries

The results of a systematic study of the behavior of a number of anionic and cationic tracers in illite, vermiculite, layered illite-vermiculite, montmorillorite, attapulgite and kaolinite are tabulated. Particle size did not have significant influence on the percentage of tracer recovered. The tracers Cs-137, P-32 and Ca-45 were of litte interest due to low recovery levels. The tracers S-35, H-3 and Br-82 gave the best yields in all forms of soil and water. A second order group comprised I-131 for clayey rocks, Cr-51 for clayey rocks, dolomitic and siliceous sands, and Na-24 for sands and clays. A third order group consisted of Ag-110 for clayey rocks, Ee-59 for clayey rocks and siliceous sands and C-14 for chalky sands.
NSA

N72-20650# Los Alamos Scientific Lab., N.Mex.
DESIGN STUDY OF A PION(MINUS) BEAM FOR BIOMEDICAL APPLICATIONS AT LAMPF
H. A. Thiessen [1972] 16 p Presented at Pion Comm. Rev. Meeting, Washington, D. C., 23 Jul. 1968
(Contract W-7405-eng-36)
(LA-DC-9789; Conf-680734-1) Avail: NTIS

The results of a preliminary design study for a biomedical pion(-) beam facility are described. The goal of the study was to design a beam which would be satisfactory for preliminary radiobiological experimentation and which could eventually be applied to radiotherapy. An essential part of this study was a calculation of the depth dose characteristics of the pion(-) beam.
Author (NSA)

N72-20651# Democritus Nuclear Research Center, Athens (Greece). Physics Dept.
[NUCLEAR PHYSICS RESEARCH AND INSTRUMENTATION DEVELOPMENT] Annual Report, 1969
C. B. Kouris, ed 1970 71 p refs
(DEMO-7018) Avail: AEC Depository Libraries

Research projects undertaken included: (1) apparatus for measuring ferromagnetism, (2) sporadic E layer in the

ionosphere, (3) horizontal magnetic storm waves, (4) pion-pion interactions and elastic scattering, (5) radiation effects on electrical resistivity of metals, (6) gamma ray-nucleon interactions and meson production, and (7) crystallography of MoFe2O4. K.P.D.

N72-20652# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France). Centre d'Etudes Nucleaires.
ACTIVITY MEASUREMENTS ON LOW CONCENTRATION RADIOACTIVE GAS IN AIR
Francois Amoudry Jul. 1971 66 p refs In FRENCH
(CEA-R-4160) Avail: AEC Depository Libraries.

Counting equipment for measuring the volumetric activity of certain gaseous fission products (Xe-133, Kr-85) is described. Two methods using the same equipment and control techniques were developed: the absolute indirect method which is applicable to a mixture of two or several gases, and the absolute direct method which can be used to measure the volumetric activity of a pure gas. Comments are made on the various experiments performed. The quality of the results obtained by these methods is discussed. Author

N72-20653# Universidad Nacional Autonoma de Mexico, Villa Obregon. Facultad de Ciencias.
METHOD OF THERMALLY STIMULATED EXOELECTRON EMISSION IN THE DOSIMETRY OF IONIZING RADIATION Ph.D. Thesis.
Hector Ursulino Rueda Jimenez Apr. 1971 71 p refs In SPANISH
(NP-18948) Avail: AEC Depository Libraries

The thermally stimulated exoelectron emission method for the dosimetry of ionizing radiations is described and its development is discussed. The model explaining this phenomenon is considered in some detail. Experimental results obtained for calcium fluoride + graphite, two graphite samples, and lithium borate activated with Mg and graphite are reported. The exoelectron emission spectra caused by X-rays and gamma rays are given. NSA

N72-20654# California Univ., Berkeley. Lawrence Radiation Lab.
EMITTANCE MEASUREMENTS ON AN ABERRATED CYLINDRICALLY SYMMETRICAL PROTON BEAM
Robert W. Allison, Jr., Robert M. Richter, and Emery Zajec Aug. 1971 4 p refs Presented at Symp. on Ion Sources and Formation of Ion Beams, Upton, N. Y., 19 Oct. 1971
(Contract W-7405-eng-48)
(LBL-307; Conf-711012-12) Avail: NTIS

Four-dimensional emittance measurements were made on an aberrated, cylindrically symmetric proton beam. The measurements indicate that, even in the presence of nonlinear effects, radial symmetry is maintained and most of the beam emittance occurs in the radial plane. The presence of a magnetic field at the plasma cup was observed to create a strong nonlinearity when the beam was tightly focused. Author (NSA)

N72-20655# California Univ., Berkeley. Lawrence Radiation Lab.
USE OF RF-KNOCKOUT FOR DETERMINATION OF THE INSTABILITY OF AN INTENSE BEAM
Dieter Moehl and Andrew M. Sessler Aug. 1971 21 p refs Presented at the 8th Intern. Conf. on High Energy Accelerators, Geneva, 20 Sep. 1971
(Contract W-7405-eng-48)
(LBL-42; Conf-710908-3) Avail: NTIS

The response of an intense beam of interacting particles to a deflecting RF signal was computed theoretically and shown to be closely related to transverse coherent beam stability. It is shown that the beam response to sinusoidal excitation provides a direct measure of the stability of beam modes for given machine conditions (beam intensity, octupole current, sextupole current, momentum spread, etc.). This measurement includes the properties of the beam surroundings, as well as the frequency spread effective for Landau damping. Author (NSA)

N72-20656# United Kingdom Atomic Energy Authority, Harwell (England).
ARCHIVE: A PROGRAM FOR STORING GAMMA SPECTRA ON MAGNETIC TAPE
R. J. Bullock and N. R. Large Aug. 1971 5 p refs
(AERE-M-2455) Avail: AEC Depository Libraries; HMSO 9p; PHI $0.55

ARCHIVE is a short program which reads gamma spectrometric data from paper or magnetic tape produced by various types of multichannel analysers and stores this information in an easily accessible form on magnetic tape. Author (NSA)

N72-20657# Tufts Univ., Medford, Mass.
HIGH ENERGY PHYSICS Progress Report, Sep. 1971
Sep. 1971 22 p refs
(Contract AT(11-1)-3023)
(TID-25852; CH-3023-1) Avail: NTIS

The summary of research presented covers strong interactions and photoproduction. A list of publications is included. NSA

N72-20658# Chicago Univ., Ill.
CANONICAL APPROACH TO HIGH ENERGY SCATTERING IN MASSIVE QUANTUM ELECTRODYNAMICS
Lay-Nam Cham and Ngee-Pong Chang (City Coll., N. Y.) Apr. 1971 33 p refs
(Contract AT(11-1)-264)
(COO-264-575; EFI-71-23) Avail: NTIS

A series of canonical transformations is introduced for the usual Hamiltonian of a neutral vector meson interaction with a conserved current, yielding an effective Hamiltonian that operates at infinite energy. The result obtained for the S-matrix operator factorizes at very high energies. The second operator describes the contribution to scattering due to pionization effects. Author (NSA)

N72-20659# Battelle-Northwest, Richland, Wash. Chemical Technology Dept.
RADIOISOTOPE BIBLIOGRAPHY: REPORTS AND PUBLICATIONS OF GENERAL ELECTRIC COMPANY, HANFORD ATOMIC PRODUCTS OPERATIONS (1960-1964) AND BATTELLE-NORTHWEST (1965-MID 1971)
J. H. Jarrett, comp. Sep. 1971 114 p refs
(Contract AT(45-1)-1830)
(BNWL-1621) Avail: NTIS

A bibliography is presented in which all the reports and publications related to radioisotopes are listed. The entries are divided into broad subject areas, indexed by author, and indexed by radioisotope. The bibliography provides a useful and usable compilation of radioisotope-related information. Author (NSA)

N72-20660# Oak Ridge National Lab., Tenn. Isotopes Div.
ISOTOPE PROGRAM (5000) Quarterly Progress Report, period ending 30 Jun. 1971
J. H. Gillette Aug. 1971 12 p
(Contract W-7405-eng-26)
(ORNL-Tm-3529) Avail: NTIS

Research and development activities are reported in target fabrication, isotopic separations, Kr-85 recovery, chemical processing, and isotope preparation for marketing. NSA

N72-20661# Battelle-Northwest, Richland, Wash. Pacific Northwest Labs.
DRAFT: A COMPUTER CODE FOR THE CALCULATION OF FISSION PRODUCT ACTIVITY RATIOS
D. R. Oden and G. D. Seybold Jun. 1971 29 p refs
(Contract AT(45-1)-1830)
(BNWL-1607) Avail: NTIS

The program DRAFT calculates information concerning fission events such as fuel isotopic concentrations and fission product disintegration rates at selected times during and after irradiation. The code was developed to provide analytical data on fission products for use in the determination of absolute neutron flux and exposure via nondestructive gamma scanning techniques. Equations used in the code are described and detailed input instructions are provided. Use of the code is illustrated with a test case, and both printed and plotted (optional) output are described. Author (NSA)

N72-20662# Delaware Univ., Newark. Dept. of Chemistry.
ROLE OF STRUCTURE AND ENERGY(OR IONIZATION) TRANSFER IN RADIATION CHEMISTRY AND BIOLOGY Progress Report, 9 Jun. 1970 - 2 Jun. 1971
Conrad N. Trumbore 2 Jun. 1971 14 p refs
(Contract AT(30-1)-3383)
(NYO-3383-19) Avail: NTIS

Pulse radiolysis studies are reported in which very small concentrations of inert salts control the decay rate of hydrated electrons, many times as concentrated as the salt. These results are interpreted in terms of structure-making and structure-breaking effects of the aqueous ions which may be exhibited for very short periods of time. A transient intermediate, tentatively designated as H2O(+) is proposed in structured regions of water, to react with the hydrated electron ten times as fast as normal diffusion-limited reactions. The implications of this theory for radiation biology are discussed. The remarkably wide range of radiation resistance in blue-green algae appears to depend on an induction of episomes or a derepression controlled by contaminants involved in cellular metabolism. Author (NSA)

N72-20663# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MEASUREMENT OF THE PARTICLE REVOLUTION FREQUENCY IN THE ELECTRON MODEL OF THE RING CYCLOTRON
D. L. Novikov, L. M. Onischenko, and P. T. Shishlyannikov 1971 15 p refs In RUSSIAN
(JINR-P9-6048) Avail: AEC Depository Libraries

For measuring signal frequency, a special storing digital frequency meter was used. To increase the accuracy of the frequency determination, which depends on the measuring time, many cycles of RF voltage modulation were use to increase the total measuring time. The measured revolution frequency coincided with that predicted, within 1 KHz: the accuracy of revolution frequency determination equals 0.00002 Author

N72-20664# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
THEORY OF s-d EXCHANGE INTERACTION IN DILUTE MAGNETIC ALLOYS
Anupam Madhukar Nov. 1971 29 p refs
(Contract AT(04-3)-822)
(CALT-822-40) Avail: NTIS

A formulation of the theory for s-d exchange interaction is derived which employs the concepts of the formal scattering theory. Starting with the Hamiltonian that characterizes the nonmagnetic host plus the magnetic impurity system, the decomposition is fixed by appropriate boundary conditions. Redecomposition, or renormalization of the decomposition is presented in the concepts of field theory. The many particle system is treated by the introduction of model space and includes particle-particle, hole-hole and particle-hole interactions. F.O.S.

N72-20665# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
[ISOTOPIC FUELS PROGRAM RELATED RESEARCH, REPORT NO. 17] Quarterly Report, Nov. 1970 - Jan. 1971
J. E. Hansen, comp. Mar. 1971 38 p refs
(Contract AT(45-1)-1830)
(BNWL-1308-5) Avail: NTIS

Results of research conducted to develop isotopic fuels are reported. Information is included on progress in programs on: waste Cs and Sr sources; utilization of fission product Pd, Rh, Ru, and Tc; large scale uses of purified fission product Xe; fission product profitability studies; nondestructive testing of irradiation sources; neutron radiography using Cf-252; advanced source development; radiation characteristics of circulatory support isotopic heat sources; and nuclear methods for seabed mineral exploration. NSA

N72-20666# Radiation Research Associates, Inc., Fort Worth, Tex.
DIFFERENTIAL MEASUREMENTS OF FAST NEUTRON AIR GROUND INTERFACE EFFECTS
R. L. French and L. G. Mooney Jul. 1971 29 p refs Sponsored by AEC
(Proj. 9.2 of Operation HENRE)
(CEX-65-92) Avail: NTIS

The effect of the air-ground interface on the scattered fast-neutron dose near the ground was measured at a distance of 1000 ft from a 14-MeV neutron source. The source was the HENRE accelerator operated at a height of 112 ft on the BREN tower at the Nevada Test Site. A horizonatl slab of polyethylene 1 ft thick and 5 ft square with Hurst-type fast-neutron dosimeters mounted on its upper and lower surfaces separated the neutrons arriving through the upper 2 pi. solid angle from those from the lower 2pi. A third detector, mounted on a boom, measured the free-field. The entire assembly was suspended by a hoist system to make measurements at 0.75 to 70 ft above the ground. The scattered dose at the detector was essentially constant, that at the bottom detector increased by a factor of approximately 2 between 0.75 and 70 ft, and the free-field dose increased by less than 25% over the same height range. The experiment provided confirmation both qualitative and quantitative, of the first-last collision model of the air-ground interface effect. Author (NSA)

N72-20667# Sandia Labs., Albuquerque, N.Mex. Experimental Aerophysics Div.
PHOTOIONIZATION OF N2 AND O2 AHEAD OF STRONG SHOCK WAVES IN A SHOCK TUBE
A. J. Mulac Oct. 1971 45 p refs Sponsored by AEC
(SC-RR-710560) Avail: NTIS

An improved calculation of photoionization ahead of strong shock waves in N2 and O2 was carried out. The calculations include a detailed kinetic model, a source of finite extent, and wall reflection. Good agreement was obtained between calculated values of electron density and values measured in previous experiments. Author (NSA)

N72-20668# Du Pont de Nemours (E. I) and Co., Aiken, S.C. Savannah River Lab.
CONFINEMENT OF AIRBORNE RADIOACTIVITY Progress Report, Jan. - Jun. 1971
A. G. Evans and L. R. Jones Oct. 1971 24 p refs
(Contract AT(07-2)-1)
(DP-1280) Avail: NTIS

Penetrating iodine compounds can be formed in carbon beds as the result of the radiation background produced by the adsorbed radioiodine. The rate of formation and desorption of these iodine compounds is a function of the radiation field strength, duration of exposure, type and service history of the carbon, and moisture content of the purge gas stream. On November 9, 1970, about 160,000 curies of particulate activity was released into the K reactor room from an irradiated antimony-beryllium source rod which melted while suspended in air. Approximately 1370 curies reached the confinement filters; only 3 millicuries escaped to the environs. Author (NSA)

N72-20669# California Univ., Livermore. Lawrence Radiation Lab.
NATURAL RADIATION BACKGROUND DOSE MEASURE-

MENTS WITH CaF2:Dy TLD
D. E. Jones, C. L. Lindeken, and R. E. McMillen 21 Sep. 1971 17 p refs Presented at 3d Intern. Conf. on Luminescence Dosimetry, Risoe, Denmark, 11-14 Oct. 1971 Sponsored by AEC
(UCRL-73432; Conf-711026-1) Avail: NTIS

Four quarterly and one monthly integrated environmental dose measurements were made with CaF2:Dy TLD's in approximately 100 homes of Lawrence Livermore Laboratory employees and at selected out-of-doors locations. A nearly uniform geographic sampling was made of background dose in the 50 United States. These data represent simultaneous integrated measurements with uniform geometry. The quarterly data also represent the average seasonal dose rates for specific locations in the Livermore Area. At the median exposure (9.6 mR) from the quarterly home data, the individual values have a standard deviation of + or - 5%. Data are summarized and the technique and methods for overcoming phosphor limitations are discussed. This technique for natural background dose measurement was found to be reliable and relatively inexpensive. The major accuracy limitation was proper recognition and handling of potential nonrandom errors. These include factors such as fading and energy dependence. The phosphor response to cosmic radition is under study as a potential source of error in TLD environmental measurements. Author (NSA)

N72-20670# Academy of Sciences (USSR), Moscow.
RESONANCE PHENOMENA DURING MULTIPHOTON IONIZATION OF XENON ATOMS IN ELECTRIC FIELDS OF E APPROXIMATELY EQUAL TO 50 MILLION V/cm
D. T. Alimov, N. K. Berezhetskaya, G. A. Delone, and N. B. Delone 1971 11 p refs In RUSSIAN
(NP-19085) Avail: AEC Depository Libraries.

A study was conducted of the eleventh ionization process for a xenon atom by means of a Nd glass laser. The amplitude of the ion signal was determined as a function of the energy of the laser radiation, and the changes in ion yield were measured. The experimental results show that for a field intensity of 5x10 to the 7th power volts/cm, the resonance effects play an essential role, whereas effects associated with a virtual transition through strongly excited levels are not manifest. NSA

N72-20671# Brookhaven National Lab., Upton, N.Y.
DEVELOPMENT OF A SYSTEM FOR TRACE ELEMENT ANALYSIS IN THE ENVIRONMENT BY CHARGED PARTICLE X-RAY FLUORESCENCE
B. M. Gordon and H. W. Kraner 1971 20 p refs Presented at Intern. Meeting on Chem. Anal. by Charged Particle Bombardment, Namur, Belgium, 5-8 Sep. 1971 Submitted for publication
(BNL-16182; Conf-710925-1) Avail: NTIS

The analysis of biological, environmental, consumer products, and lunar samples for trace elements by a charged particle X-ray fluorescence method using accelerated protons and He-4 ions is reported. NSA

N72-20672# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ON-LINE ACQUISITION OF DATA IN PHOTONUCLEAR REACTIONS [ACQUISITION EN LIGNE DES DONNEES D'UNE EXPERIENCE PHOTONUCLEAIRE]
Pierre Daujat Aug. 1971 50 p refs In FRENCH
(CEA-N-1465) Avail: AEC Depository Libraries

The on-line data acquisition system used for photonuclear reactions of the (gamma, xn) type obtained with a monochromatic gamma beam at the 70 MeV linac, consists of two interconnected devices. The STDAN which collect and stocks the experimental data and an on-line PDP8 I computer which evaluates these data, supervises the experiment controlling program and corrects some of linac parameters. NSA

N72-20673# Institute of Nuclear Sciences, Lower Hutt (New Zealand).
[NUCLEAR PHYSICS AND CHEMISTRY RESEARCH] Progress Report, Jul. - Dec. 1970
Dec. 1970 96 p
(INS-459; SIR(INS)-5; AEC-362; PR-16) Avail: AEC Depository Libraries

Brief summaries are presented for research in the fields of nuclear physics, including instrumentation, accelerators, and data analysis equipment; radiation chemistry; stable isotope geochemistry, radioisotope dating and fallout; isotope applications; and instrumentation and electronics. Lists of current research projects, staff, papers, and reports issued during the period are appended. NSA

N72-20674# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
APPLICATION OF IONIZING RADIATION SPECTROMETRY TO NONDESTRUCTIVE TESTING [APPLICATIONS DE LA SPECTROMETRIE DES RADIATIONS IONISANTES AUX CONTROLES NON DESTRUCTIES]
J. Bourrieau Nov. 1971 74 p refs In FRENCH
(ONERA-NT-02-26-71) Avail: NTIS

Some theoretical observations on charged particle-matter, photon-matter, and neutron-matter interactions are considered and induced effects in the matter discussed. Some applications of X-ray fluorescence, retrodiffusion of heavy charged particles, and capture of gamma rays are discussed. These applications include the measurement of thin film thickness and antifriction deposits on steels, the determination of pollution traces on surfaces, and the analysis of traces in materials. ESRO

N72-20675# Rome Univ. (Italy). Inst. of Physics.
THE HYPERSPHERICAL-EXPANSION APPROACH TO NUCLEAR BOUND STATES. 4: THE LIMIT OF LARGE A FOR VELOCITY-DEPENDENT POTENTIALS
F. Calogero, A. DAndrea, E. Olivieri, O. Ragnisco, M. Scalia, Y. A. Simonov (Inst. of Theoret. and Exptl. Phys., Moscow), and E. L. Surkov (Kurchatov Inst. of Atomic Energy) 17 Apr. 1971 54 p refs Sponsored in part by CNR and CERN
(Nota-Interna-313) Avail: NTIS

The first approximation of the hyperspherical-expansion approach to nuclear bound states is discussed for large nucleon number limit. For velocity independent potentials the results previously given are derived and a complete discussion of the next-to-leading terms in the asymptotic formula for the binding energy is given. For velocity dependent potentials similar results are obtained. The density distribution is computed and discussed and a comparison with the binding energy per nucleon formulae obtained in the Fermi gas treatment of the nuclear matter is made. Numerical results for velocity-dependent potentials of Nestorm, Davies, Krieger, and Baranger are reported. ESRO

N72-20676# Rome Univ. (Italy). Inst. of Physics.
HIGH ENERGY PHENOMENOLOGY OF PI N AND KN FORWARD SCATTERING
M. Restignoli, D. Schiff (Maryland Univ., College Park), and G. Violini 24 May 1971 16 p refs
(Nota-Interna-318) Avail: NTIS

Regge pole models were tested using finite energy sum rules in pion-nucleon scattering. The K meson-nucleon total cross sections were analyzed, and it was found that a conventional model permits fitting the data within the allowable errors (both statistical and systematic). Author (ESRO)

N72-20677# Rome Univ. (Italy). Inst. of Physics.
RESULTS FROM STORAGE RINGS
B. Borgia 25 May 1971 42 p refs Presented at the Conf. on Elementary Particle Phys., Lancaster, Engl., 5-7 Apr. 1971
(Nota-Interna-319) Avail: NTIS

The validity of quantum electrodynamics hypothesis is verified by the study of the gamma-gamma, muon anitmuon, proton-antiproton annihilation reactions, an electron-positron scattering during electron and positron interactions in storage

rings. The measurements are concordant with standard QED predictions. The meson vector dominance model is investigated by observing and measuring the rho, phi, and omega meson coupling constants and decay parameters. A discrepancy is noted above the 1.4 GeV energy region and an explanation is given.
ESRO

N72-20678# Panametrics, Inc., Waltham, Mass.
RADIATIVE BEHAVIOR OF METAL OXIDES IN LASER BLOWOFF Final Report, 10 Jun. 1970 - Jul. 1971
Tunis Wentink, Jr., Norman Pedersen, and Gerald Diebold 9 May 1971 61 p refs
(Contract DASA01-70-C-0155; ARPA Order 1433)
(AD-734897; DASA-2704) Avail: NTIS CSCL 07/4

Radiative lifetimes of selected molecular and atomic levels were measured in the vapor produced by laser blowoff; i.e., by pulsed vaporization of solid targets in vacuum, illuminated by focused laser radiation. AlO, FeO, C2, Al, Li, and U spectra so produced were recorded, and AlO, Al, C2, and Li lifetimes were measured. Literature surveys on the laser blowoff effect and AlO, FeO, and BaO spectra and intensities are discussed. Recommendations for future work are made. Author (GRA)

N72-20776*# Techtran Corp., Glen Burnie, Md.
TWO PARTICLE INELASTIC REACTION WITH EXCHANGE OF A BARYON HAVING SPIN OF 3/2
Ye. V. Beter and Yu. G. Gulyamov *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 45-47 (See N72-20774 11-29)
Avail: NTIS CSCL 20H

N72-20777*# Techtran Corp., Glen Burnie, Md.
INELASTIC NEGATIVE PION p-INTERACTIONS WITH SMALL MOMENTUM TRANSFER
S. A. Azimov, Kh. A. Rizayev, and A. A. Yuldashev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 48-58 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

N72-20778*# Techtran Corp., Glen Burnie, Md.
INELASTIC pp-INTERACTIONS AT AN ENERGY OF 6 GeV WITH LOW MOMENTUM TRANSFER
S. A. Azimov, Yu. G. Gulyamov, and B. G. Rakhimbayev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 59-64 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

N72-20779*# Techtran Corp., Glen Burnie, Md.
INTERACTION OF 30.8 GeV/c PROTONS WITH HEAVY EMULSION NUCLEI IN A STRONG MAGNETIC FIELD
S. A. Azimov, Yu. G. Gulyamov, N. M. Myalkovskaya, A. L. Svechnikova, L. P. Chernova, and G. M. Chernov *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 65-79 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

N72-20780*# Techtran Corp., Glen Burnie, Md.
INTERACTION OF PROTONS WITH ENERGIES IN TENS OF GeV WITH HEAVY EMULSION NUCLEI AND A MODEL OF THE INTRANUCLEAR CASCADE
S. A. Azimov, Yu. G. Gulyamov, L. P. Chernova, and G. M. Chernov *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 80-84 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

N72-20781*# Techtran Corp., Glen Burnie, Md.
PERSPECTIVES FOR INVESTIGATIONS OF CHARACTERISTICS OF NUCLEAR INTERACTIONS AT ENERGIES OF 10 TO THE ELEVENTH POWER THROUGH 10 TO THE THIRTEENTH eV ON THE LARGE INSTALLATION AT THE HIGH ALTITUDE STATION KUM-BEL OF THE INSTITUTE OF NUCLEAR PHYSICS OF THE ACADEMY OF SCIENCES OF THE UZBEK SSR
A. M. Abdullayev, S. A. Azimov, Kh. Zaynutdinov, E. Mulladzhanov, V. M. Myalkovskiy, and T. S. Yuldashbayev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 85-100 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-20679 National Lending Library for Science and Technology, Boston Spa (England).
THE MECHANISM OF TURBULENT HEATING AND OF LOSSES IN TOKAMAK DEVICES
L. I. Rudakov Aug. 1971 16 p refs Transl. into ENGLISH of I.V. Kurchatov Inst. of Atomic Energy, Moscow, report CN-28/E-15 Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 1971
(NLL-CTO-777-(9091.9F); CN-28/E-15) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

It is shown that there is another mechanism of heating, besides the turbulent Joule heating of a plasma by a current flowing along a magnetic field owing to the increased effective electron scattering frequency by ion-acoustic instability. The heating is associated with electron cyclotron instability. It is shown that under these conditions runaway may not occur (i.e. the rapid rise of the current after the electron temperature increases, as in the solutions derived without allowance for the magnetic field effects). In a strong magnetic field, turbulent heating may be caused by the combined action of the ion-acoustic and cyclotron instabilities. The laws of turbulent heating of ions and electrons in the TM-3 device are analysed from this standpoint. It is shown from the experimental results that the characteristic loss time for hot ions is determined by 'classical' diffusion through scattering by electric field fluctuatins. It is predicted that the overheating instability will cause the current to flow along thin filaments, where the heat associated with 'classical' losses is evolved. Author

N72-20680*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
EXPERIMENTAL INVESTIGATIONS OF A URANIUM PLASMA PERTINENT TO A SELF-SUSTAINING PLASMA SOURCE
Richard T. Schneider Dec. 1971 40 p refs
(Grant NGL-10-005-089)
(NASA-CR-125814) Avail: NTIS CSCL 20I

The research is pertinent to the realization of a self-sustained fissioning plasma for applications such as nuclear propulsion, closed cycle MHD power generation using a plasma core reactor, and heat engines such as the nuclear piston engine, as well as the direct conversion of fission energy into optical radiation (nuclear pumped lasers). Diagnostic measurement methods and experimental devices simulating plasma core reactor conditions are discussed. Studies on the following topics are considered: (1) ballistic piston compressor (U-235); (2) high pressure uranium plasma (natural uranium); (3) sliding spark discharge (natural uranium); (4) fission fragment interaction (He-3 and U-235); and (5) nuclear pumped lasers (He-3 and U-235). Author

N72-20681*# California Univ., Los Angeles. Plasma Physics Group.
POLARIZATION OF THE AURORAL ELECTROJET
F. V. Coroniti and C. F. Kennel Feb. 1972 53 p refs

(Grants NGR-05-007-190; NGR-05-007-116; Contract AT(04-3)-34; N00014-69-A-0200-4023; NSF GP-22817)
(NASA-CR-125917; PPG-112) Avail: NTIS CSCL 20E

Precipitation from the inner edge of the electron plasma sheet creates a density maximum in the auroral oval ionosphere, which in turn leads to Hall and Pedersen conductance maxima. A uniform westward convection electric field is imposed upon the lower ionosphere previous to polarization. Field-aligned currents flow into the ionosphere equatorward, and out poleward, of the Hall conductance maximum. As the convection field and ionospheric density increase during substorm growth phase, the field-aligned current densities eventually reach an instability threshold, beyond which anomalous resistance produces field-aligned electric fields. The partial blockage of the field-aligned currents produces an equatorward electric field and therefore a partial Cowling conductivity in the lower ionosphere. Author

N72-20682# Nagoya Univ. (Japan). Inst. of Plasma Physics.
[PLASMA PHYSICS RESEARCH AND INSTRUMENTATION] Annual Review, Apr. 1970 - Mar. 1971
Mar. 1971 199 p refs
Avail: NTIS

Experiments in plasma research, technology and applied plasma physics, and plasma theory and computation are reported. The following research activities are identified as being of special interest: Several toroidal confinement devices were constructed. One is a stellarator with l = 3 helical winding with which the convection or electric potential distribution was found. A smaller stellarator with l = 2 helical winding and a big vacuum chamber for current multipole experiments were constructed. A toroidal plasma experiment was done in the caulked cusp torus or toroidal pinch, whose discharge tube contains conducting rings to prevent toroidal drift of the plasma. Work was done on the Tokamak to operate it continuously, and a toroidal current of a 100 amperes was kept in the toroidal discharge tube. Experiments on a 100 kJ theta pinch, diffusion pinches, hot electron plasma, and other plasma devices are also described. N.E.N.

N72-20683# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A PRELIMINARY EXPERIMENT ON CURRENT SUSTAINING IN A MAGNETIZED TOROIDAL PALSMA
Keiichi Hirano, Akihiro Mohri, and Kiyokata Matsuura Nov. 1971 24 p refs
(IPPJ-112) Avail: NTIS

It is experimentally shown that a traveling magnetic field along a torus induces dc toroidal current in a plasma. The circulating toroidal current changes sensitively when the toroidal magnetic field is applied. The results are explained by excitation of whistler waves. The maximum current achieved is about 180 A. It is found that electrons moving with the traveling wave are trapped in mirror or cusp regions formed by the traveling and the dc toroidal magnetic fields. Author

N72-20684# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DEPENDENCE OF PLASMA DENSITY FLUCTUATION ON ELECTRIC FIELD CONTROLLED BY METAL ENDS
Johshin Uramoto Nov. 1971 10 p refs
(IPPJ-113) Avail: NTIS

Density fluctuations in a plasma streaming along a uniform magnetic field B were investigated while controlling an electric field across b through two metal end plates. The fluctuations decrease to a minimum when the electric field approaches to zero. However, the fluctuations are local and not related to an enhanced diffusion. Author

N72-20685# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RADIAL PROPAGATION OF DRIFT WAVE IN FINITE LENGTH PLASMA
Johshin Uramoto Nov. 1971 21 p refs
(IPPJ-114) Avail: NTIS

Radial propagations of a drift wave, excited near a plasma column in a uniform magnetic field B, are investigated under two metal or insulator end plates. For the insulator ends, the drift wave propagates across B (radially), while, for the metal ends, it damps abruptly. These results are explained from a short effect of the ends for the wave potential and an enhanced diffusion. Author

N72-20686# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AN ASYMPTOTIC METHOD FOR THE VLASOV EQUATION. 3: TRANSITION FROM AMPLITUDE OSCILLATION TO LINEAR LANDAU DAMPING
Ryo Sugihara and Tetsuo Kamimura Jan. 1972 41 p refs
(IPPJ-116) Avail: NTIS

The basic equations cover the amplitude oscillation, the linear Landau damping, and intermediate regions on wave behaviors. It was found that a plateau is formed in a temporal profile of amplitude of an electric field D for q is much less than 1 but also for q is approximately less than 0.5 the plateau seems to be constructed. Another kind of plateau appears for q is equavilent to 0.77 and for q is less than 0.77 the wave damps out (not necessarily Landau-damped). Time evolution of the number of trapped electrons and of distributions of resonant electrons are shown. It is found that even if D is almost saturated when q is much less than 1 the corresponding distribution is not necessarily seen to be flat. Author

N72-20687# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PLASMA GENERATION AND HEATING TO THERMONUCLEAR TEMPERATURE BY LASERS
C. Yamanaka (Osaka Univ.), T. Yamanaka (Osaka Univ.), T. Sasaki (Osaka Univ.), K. Yoshida (Osaka Univ.), M. Waki (Osaka Univ.), and H. Kang Jan. 1972 36 p refs
(IPPJ-117) Avail: NTIS

The production of a thermonuclear temperature plasma using plasma laser energy is discussed. The neutron yield from a solid deuterium target irradiated by the beam of glass laser, the power of which was 20 GW at 2 ns., was observed. The estimated threshold of laser power for anomalous heating due to parametric instability was in accord with the experimental results. Beyond this threshold, the increase of the electron temperature, the appearance of a fast ion group and the anomality of the light reflection from plasma were discovered. These phenomena were closely correlated with the neutron yield. At the high temperature region above a few hundred electron volts, this kind of anomalous heating has an essential role to reach the fusion reaction temperature. Author

N72-20688# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
END LOOP SHORTING IN NONEQUILIBRIUM MHD GENERATORS
Reiner Decher 9 Mar. 1972 44 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Aug. 1972
(Grant NSF GK-5393)
Avail: NTIS

Aerodynamic means to minimize the internal shorting of a nonequilibrium MHD generator through its own exit region were investigated. It was assumed that highly conducting electrode wall gas layers form from current concentrations on finite sized electrodes, and that these wall layers provide the path for current, generated in the active section, to short through the generator exit. It is shown that shock free flow in the exit is desirable. A weak shock at the exit but within the magnetic field of a working generator can be used to maximize the electron density recombination rate, thus maximizing the exit region impedance. Author

N72-20689*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COAXIAL HIGH DENSITY, HYPERVELOCITY PLASMA GENERATOR AND ACCELERATOR Patent Application
Patrick N. Espy, inventor (to NASA) Filed 31 Dec. 1970 17 p

(NASA-Case-MFS-20589; US-Patent-Appl-SN-103077) Avail: NTIS CSCL 20E

A high density plasma generating and accelerating device is described, which has a tubular outer electrode and a rod-like central electrode. A foil disk mounted over the central electrode extends radially outward to the outer electrode to bridge the electrode gap and form a shorting path. A capacitor bank is connected across the electrodes, which discharges through and ionizes the foil disk to produce a dense plasma of ionized particles. The plasma is accelerated by the electrical and magnetic fields set up when a potential is applied to the electrodes. NASA

N72-20690# Electrotechnical Lab., Tokyo (Japan).
THEORY OF NONLINEAR INTERACTION OF WAVES IN A PLASMA WITHOUT AN EXTERNAL MAGNETIC FIELD
Takasi Kurasawa Sep. 1971 84 p refs
(Rept-718) Avail: NTIS

Various theories concerning the nonlinear interaction of waves in a weakly turbulent plasma are organized from a quantum mechanical viewpoint, based on the Bohm-Pines description. The kinetic equations describing the interactions of a particle with two waves and of three waves are obtained by a quantum statistical treatment for Hamiltonians describing the nonlinear interaction between a particle and quasi-particles (waves). The Hamiltonians are obtained by extending the Bohm-Pines description to nonlinear interaction of waves in an ion-electron plasma with a transverse electromagnetic field. Author

N72-20691*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETO PLASMA DYNAMIC ARC THRUSTER Patent Application
James A. Burkhart, inventor (to NASA) Filed 30 Apr. 1971 14 p
(NASA-Case-LEW-11180-1; US-Patent-Appl-SN-175852) Avail: NTIS CSCL 20I

A method is described for improving the performance of a magnetohydrodynamic arc thruster in the 600 to 2100 second specific impulse range. This is accomplished by locating the thruster cathode in the exhaust beam, downstream from the anode and main propellant injection point. NASA

N72-20692# Technische Hogeschool, Delft (Netherlands).
DESIGN AND CHARACTERISTICS OF A ROTATING PLASMA DEVICE
Jan Gerard Bannenberg 6 Oct. 1971 103 p refs
(NP-19059) Avail: AEC Depository Libraries

After a short review of earlier experiments on rotating plasmas, the features of the Kruisvuur 2 device are given, including the diagnostics used. The problems associated with the parallel operation of a large number of switches (ignitrons) necessary to carry the 0.3-MA current for each coil are also treated. The dynamic behavior of a hydrogen puff, released by a fast valve, was studied. Attempts were made to determine plasma conditions from external measurements. The plasma energy was measured with diamagnetic loops and compared with theoretical calculations. Author (NSA)

N72-20693# Commissariat a l'Energie Atomique, Saclay (France). Center d'Etudes Nucleaires.
KAMOKOT PROBLEM [PROBLEME KAMOKOT]
Jean-Pierre Alfonsi and Jean-Paul Boujot Aug. 1971 36 p refs In FRENCH
(CEA-N-1464) Avail: AEC Depository Libraries

A description is given of the way in which a numerical program is used to simulate the Tokamak experiment. The choice of mathematical model is discussed: the toroidal effect in neglected; the hydrodynamic description of a given plasma by the MHD system deduced from the BBGKY system is used. A two-fluid model with cylindrical geometry is then introduced, and a numerical treatment of the system obtained in indicated. NSA

N72-20694# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.
MAGNETOHYDRODYNAMICS OF THE FOCUS DISCHARGE (NONCYLINDRICAL SELF-CONSTRICTION) [ETUDE MAGNETOHYDRODYNAMIQUE DE LA DECHARGE FOCUS (AUTOSTRICTION NON CYLINDRIQUE)]
Robert Vezin Aug. 1971 90 p refs In FRENCH
(CEA-R-4219) Avail: AEC Depository Libraries

The Potter magnetohydrodynamic code was used. This code involves a two-dimensional fluid model with two temperatures and the transverse transport coefficients of a fully ionized plasma. When applied to the Focus geometry used at Limeil, temperatures consistent with the Bennett law, but much lower than those evaluated experimentally using X-ray absorbing foil techniques, are obtained. NSA

N72-20695# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
INVESTIGATION OF AMPLITUDE REFLECTION OF ELECTROMAGNETIC WAVES FROM BOUNDARIES OF ANISOTROPIC PLASMA
I. Yu. Adamov, V. L. Berezhnyi, L. A. Dushin, P. M. Lebedev, and V. I. Kononenko 1971 10 p refs In RUSSIAN
(KHFTI-71-25) Avail: AEC Depository Libraries

The characteristic amplitude of a reflected electromagnetic wave from an anisotropic plasma was calculated by means of an electronic computer. The boundary of the plasma was oriented perpendicularly to the magnetic field. The dependence of the amplitude upon plasma density, number of encounters, magnetic field, and the frequency of the signal probing the plasma, were determined. These relations may be used in a practical fashion for defining the density of an anisotropic plasma and measuring the amplitude of a reflected electromagnetic wave. Author (NSA)

N72-20696# Academy of Sciences (USSR), Leningrad.
MICROWAVE ABSORPTION BY PLASMA ESSENTIALLY INHOMOGENEOUS ALONG THE MAGNETIC FIELD LINES
V. I. Arkhipenko and V. N. Budnikov 1971 22 p refs In RUSSIAN; ENGLISH summary
(NP-19083) Avail: AEC Depository Libraries

The plasma was produced by 3-cm microwaves under electron cyclotron resonance conditions at the end of a long narrow discharge tube filled with argon. Effective microwave absorption (up to 60%) was found to take place in the plasma. The plasma density increased and, hence, the microwave power absorption was found outside the 10-cm waveguide at distances 10 to 25 cm. The microwave power absorption region was localized near the cross section where the maximum density is equal to the critical one. The displacement of the cross section led to the displacement of the absorption region. It was found that under the experimental conditions a plasma waveguide was formed, along which the microwave power propagated to the cross section without visible attenuation. The discussion concerning the location of the absorption region is based on the theory of wave transformation in plasma with two-dimensional inhomogeneities. Author (NSA)

N72-20697# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SPATIAL AND TEMPORAL HF PLASMA RESPONSE TO AN EXTERNALLY APPLIED PULSE
P. Demuliere, M. Guillemot, J. Olivain, F. Perceval, and A. Quemeneur 1971 10 p refs Presented at 3d Intern. Conf. on Quiescent Plasma, Elsinore, Denmark, 20-24 Sep. 1971
(CEA-CONF-1860; CONF-710929-3) Avail: AEC Depository Libraries

The response of electrons in a collisionless plasma to a fast small amplitude electrical pulse was investigated theoretically and experimentally. The response, which is proportional to the excitation, is pseudoperiodic after a delay equal to z/V sub g max, V sub g max being the maximum group velocity of the induced waves and z, the distance between the emitter and the

receiver. The amplitude of the signal decreases and its pseudoperiod increases with increasing z. NSA

N72-20698# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EVOLUTION OF PLASMA IN TOKAMAK-TYPE CONFIGURATION

Jean-Paul Bayard, Jean-Paul Roujot, and Jean-Louis Soule Aug. 1971 47 p In FRENCH

(CEA-N-1463) Avail: AEC Depository Libraries

A numerical program used for simulating a Tokamak experiment is described. The toroidal effect was neglected and the plasma hydrodynamics are described using an MHD system. A one-fluid model with cylindrical geometry was then introduced. The choice of this mathematical model is discussed. An analytical treatment is given for a simplified case. NSA

N72-20699# Academy of Sciences (USSR), Moscow. Inst. of Physics.

ANOMALOUS ABSORPTION OF ELECTROMAGNETIC WAVES IN MAGNETIZED PLASMA

G. M. Batanov, L. M. Gorbunov, and K. A. Sarksyan 1971 9 p refs In RUSSIAN

(NP-19061) Avail: AEC Depository Libraries

Absorption of electromagnetic waves (of the SHF range) in magnetized collisionless plasma is experimentally analyzed. The dependence of transmission factors and wave absorption on incident wave power is determined. It is found that wave absorption is maximum at some wave power. The experimental results are compared with theoretical results. The dependence of the effective collision frequency on wave power is presented. It is assumed that the observed phenomenon of anomalous absorption is related to the development of parametric instability in the plasma. NSA

N72-20700# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

AMPLITUDE OF ELECTRON PLASMA WAVE ECHOES

M. Guillemot, J. Olivain, F. Perceval, A. Quemeneur, and G. Matthieussent (Paris Univ., Orsay, France) [1970] 10 p refs Presented at the 3d Intern. Conf. on Quiescent Plasmas, Elsinore, Denmark, 20 Sep. 1971

(CEA-Conf-1865; Conf-710929-6) Avail: AEC Depository Libraries

Experimental results of spatial plasma wave echoes are presented. They show the observed echoes are dominated by collective effects; the dissymmetric role played by the two emitters on the amplitude and on the profile of the echo; and the decay of the amplitude of the echo under the influence of a homogeneous noise (plasma noise) and an inhomogeneous noise (random noise generator). Author (NSA)

N72-20701# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

LARGE-AMPLITUDE WAVE INTERACTION WITH A PLASMA: TRAPPING EFFECTS

M. Guillemot, J. Olivain, F. Perceval, and A. Quemeneur [1971] 14 p refs Presented at the 30 Intern. Conf. on Quiescent Plasmas, Elsinore, Denmark, 20 Sep. 1971

(CEA-Conf-1864; Conf-710929-5) Avail: AEC Depository Libraries

In order to obtain the theoretical distribution function, the Vlasov equation is solved using the free-trajectories method. These calculations, valid for weakly damped waves, show that the particles are divided into two classes: the first consisting of untrapped particles and the other consisting of particles trapped in the potential well of the wave. For an initially Maxwellian distribution the instantaneous distribution function is numerically calculated. NSA

N72-20702# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

RESONANT CHARACTERISTICS OF COLLISIONLESS DRIFT WAVES IN HYDROGEN PLASMA: COMPARISON BETWEEN EXPERIMENTAL RESULTS AND LINEAR THEORY

R. Boissier, P. Brossier, P. Deschamps, R. Gravier, R. Pellat, and C. Renaud [1971] 8 p refs Presented at the 3d Intern. Conf. on Quiescent Plasmas, Elsinore, Denmark, 20 Sep. 1971

(CEA-Conf-1863; Conf-710929-4) Avail: AEC Depository Libraries

Spontaneous collisionless drift waves driven by a pressure gradient perpendicular to the confining magnetic field are observed in the low beta plasma of the ODE device. The experiment was designed specifically to study this instability, characterized by very long parallel wavelengths, which results from the resonant coupling between the wave and the electrons. A double-ended device produces a 5.4-m-long collisionless hydrogen plasma confined by a uniform magnetic field. Detailed measurements of the unstable models were performed by correlation techniques using a 10-MHz-bandwidth real time correlator. The experimental dispersion curves are compared with the computed solutions of the linear dispersion relation.

Author (NSA)

N72-20703# Academy of Sciences (USSR), Moscow.

ANOMALOUS RESONANCE IN SHF HEATING OF ELECTRONS IN MAGNETIZED PLASMA

G. M. Batanov and K. A. Sarksyan 1971 9 p refs In RUSSIAN

(NP-19060) Avail: AEC Depository Libraries

SHF heating of electrons in a magnetized, collisionless plasma is experimentally analyzed in the region of magnetic fields resonances were detected in the dependence of heating efficiency on the magnetic field. The dependence of heating efficiency on plasma density is also of a resonance character for omega sub Le/omega sub 0 > 1. The discovered effects are related to parametric excitation of potential waves in the plasma. NSA

N72-20704# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires

T SUB i DIAGNOSTICS USING THE INCOHERENT SCATTERING OF A MILLIMETER WAVE BY A PLASMA WITH n sub e APPROXIMATELY EQUAL TO 10 TO THE 13TH POWER el/CU CM

D. Lepechinsky Jun. 1971 5 p refs In FRENCH

(EUR-CEA-FC-600) Avail: AEC Depository Libraries

A T sub i diagnostic using the incoherent scattering of a ten watt millimeter wave by a plasma with five times 10 to the 13th power electrons per cubic centimeter and T sub e equal to 100 electron volts is demonstrated to be possible from the point of view of signal to noise ratio. The difficult arising from the choice of filter for the central frequency of the spectrum is emphasized. NSA

N72-20705# Iowa Univ., Iowa City. Dept. of Physics and Astronomy

QUASILINEAR THEORY, REVISED AND TESTED

Thomas Burns and George Knorr Jul. 1971 52 p refs

(Contract AT(11-1)-2059)

(COO-2059-8; Rept-71-39) Avail: NTIS

The quasi-linear theory is revised analytically and its consequences are tested by a numerical simulation for a one-dimensional periodic electron plasma with discrete electrostatic modes. The numerical model is a Vlasov-Poisson system where the mode-mode coupling terms were omitted. The result is that the predictions of the analytical theory are confirmed by simulation. For all cases considered there are always several modes that are initially unstable, but become damped at a later time so that an inclusion of damped modes in the theory is absolutely necessary. Author (NSA)

N72-20706# United Kingdom Atomic Energy Authority, Culham (England).
TURBULENCE AND HEATING IN A PLASMA CARRYING A TRANSVERSE CURRENT
V. V. Demchenko, V. L. Sizenko, and K. N. Stepanov Sep. 1971 14 p refs Transl. into ENGLISH of Akad. Nauk Ukr. SSR, Fiz.-Tekhn. Inst., Kharkov, report KhFTI-70-62
(CTO/770; KhFTI-70-62) Avail: AEC Depository Libraries

Estimates are given for the magnitude of the turbulent fluctuations of density and velocity of electrons and ions and of the electric field in a plasma carrying a current at right angles to the magnetic field. An estimate is made of the cross section for Raman scattering of microwaves by turbulent fluctuations of the electron density, and the values obtained are compared with the experimental results. It is shown that in such a plasma there exists an effective mechanism for heating of nonresonant ions, due to the finite correlation time of the electric field fluctuations.
Author (NSA)

N72-20707# United Kingdom Atomic Energy Authority, Culham (England).
ASYMPTOTIC SOLUTION IN THE PROBLEM OF ANOMALOUS RESISTIVITY OF A COLLISIONLESS PLASMA
G. E. Vekshtein, D. D. Ryutov, and R. Z. Sagdeev Sep. 1971 19 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Inst. Yadernoi Fiz., Novosibirsk, report IYaF-97-70
(CTO/771; IYaF-97-70) Avail: AEC Depository Libraries

The time variation of the charged-particle distribution functions in a homogeneous plasma in an external electric field is discussed, and it is shown that, as t yields infinity, the distribution functions have a similarity variation, all velocities increasing linearly with time. It is found that, when the current is parallel to the external magnetic field, the directed velocity of the electrons varies in essentially the same manner as in free acceleration. If the current is perpendicular to the external magnetic field, there is no runaway, and the ratio of the directed and thermal velocities of the electrons becomes much less than unity.
Author (NSA)

N72-20708# Institut Atomnoi Energii, Moscow (USSR).
PLASMA COMMUTATOR FOR HIGH-POWER PULSED CIRCUITS
V. S. Komelkov and V. I. Modzolevskii 1970 24 p refs In RUSSIAN
(IAE-2008) Avail: AEC Depository Libraries

A method is described for closing a circuit of high-power pulsed equipment by means of a high-density plasma jet moving at 2 to 3 km/sec. The jet is generated in air, at atmospheric pressure, by operating currents flowing in a commutated circuit. The circuit-closing time may be varied between 1.5 to 20 microseconds by means of a current change in the circuit and the distance of the closing interval. During commutation in the first half-period (T/4 and T/2), the spread in closing time amounts to plus or minus 0.3 to 0.4 microseconds. The commutator is of simple construction and may be utilized in a wide variety of experimental and industrial situations.
Author (NSA)

N72-20709# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etude Nucleaires.
MHD EQUILIBRIUM CHARACTERISTICS
G. M. Bouligand Jun. 1971 37 p refs In FRENCH
(EUR-CEA-FC-604) Avail: AEC Depository Libraries

The Cauchy problem is considered for the case of MHD equilibria; equilibria are sought from the known values of the pressure and the magnetic field components at every point in any given surface S. The problem was not explicitly solved, the first partial derivatives of the field and pressure being determined for every point in S.
NSA

N72-20710# Akademiya Nauk URSR, Kiev. Fiziko-Tekhnicheskii Inst.
NONLINEAR THEORY OF RELAXATION OF MONOENERGETIC BEAMS IN PLASMA
V. D. Shapiro and V. I. Shevchenko 1970 24 p refs In RUSSIAN
(KHFTI-70-69) Avail: AEC Depository Libraries

In the process of relaxation, instability plays a role in the beam particles trapped in potential oscillations. The equations obtained describe the oscillation excitation and the diffusion in the beam with respect to this instability. From these considerations the distribution function of the beam approximates a plateau in consideration of time, plasma frequency, and densities of beam and plasma. During subsequent stages of relaxation with a characteristics time, a particle acceleration appears in the beam and a velocity distribution is established that approximates a Maxwellian distribution.
Author (NSA)

N72-20711# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
DYNAMIC STABILIZATION OF THE HELICAL m EQUALS 1 INSTABILITY ON A LINEAR SCREW PINCH
Otto Gruber Aug. 1971 60 p refs In GERMAN; ENGLISH summary
(IPP-1/121) Avail: AEC Depository Libraries

The experimentally determined growth rates and wavelengths of the modes are about the same as in a toroidal screw pinch and both agree well with theory. Two methods were investigated. In both cases the stabilizing effects were better than expected from theory. In the first method an axially uniform oscillating field was superposed on the quasi-steady field. The m = 1 mode is stabilized and a stabilization condition holds. This stabilizing effect is very likely caused by inertial forces produced by enforced m = 0, k = 0 oscillations of the plasma column. Working in resonance with the natural plasma oscillations the condition above is easier to fulfill. In the second method only oscillating currents were added to the axial plasma current to study the stabilization by dynamic shear. Magnetic probe measurements showed that the current flows in the dilute plasma outside the dense plasma column. The measured skin depths and resistivities are larger than those expected from classical theory.
Author (NSA)

N72-20712# Democritus Nuclear Research Center, Athens (Greece). Physics Dept.
DISPERSION RELATIONS IN A MAGNETOELECTRIC MEDIUM (STATISTICAL PLASMA)
J. S. Nicolis and E. Athanassoula-Georgala Oct. 1971 20 p refs
(DEMO-71/21) Avail: AEC Depository Libraries

Dispersion relations are derived for plane electromagnetic wave propagation in a homogeneous charge-equilibrated electron gas characterized by a continuous (isotropic) velocity distribution. The dispersion curves are studied as a function of the upper bound velocity and the angle between the propagation and velocity vectors, for an electron distribution function which is constant in a bounded region of phase space and zero outside this region (water-bag model).
Author (NSA)

N72-20713# Los Alamos Scientific Lab., N.Mex.
SUBSTORM BEHAVIOR OF PLASMA SHEET PARTICLES
Edward W. Hones, Jr. [1971] 26 p refs Sponsored by AEC
(LA-DC-12711) Avail: NTIS

The general features of plasma sheet substorm behavior established from Vela satellite data are described. A feature of the magnetotail behavior during a substorm is the thinning and subsequent thickening or recovery of the plasma sheet. Observational data support these features: (1) magnetic field erosion from the front of the magnetosphere before the expansive phase of a substorm, (2) buildup of tail magnetic field strength early in substorms, (3) magnetic field line contraction or collapse toward the earth during the expansive phase of substorms, and (4) movement of the inner edge of the plasma sheet toward the earth during substorms.
NSA

N72-20714# Academy of Sciences (USSR), Leningrad.
CHARACTERISTICS OF FORMATION OF MICROWAVE DISCHARGES IN PLASMA AT MAGNETIC FIELDS HIGHER THAN THE CYCLOTRON FIELD
V. I. Arkhipenko, V. N. Budnikov, and A. A. Bukhov 1971 11 p refs In RUSSIAN; ENGLISH summary
(NP-19073) Avail: AEC Depository Libraries

A microwave discharge formed at magnetic fields higher than the cyclotron value far from the absorption boundary was studied. An argon plasma at pressure 0.1 to 0.001 mm Hg was created by 10-cm microwaves. The quartz discharge tube was 70 cm long and 2.5 cm in diameter and placed in a 10-cm waveguide. Some lines in the absorption region of a parametric space were discovered. The location of the lines is described by equations of the one-dimensional wave transformation theory similar to those describing the transformation boundary.
Author (NSA)

N72-20715# Academy of Sciences (USSR), Leningrad.
WAVE PENETRATION INTO A PLASMA AT LOW HYBRID FREQUENCIES
V. E. Golant 1971 30 p refs In RUSSIAN; ENGLISH summary
(NP-19076) Avail: AEC Depository Libraries

The penetration of electromagnetic waves into a low hybrid resonance region in magnetized plasma is discussed. The conditions of wave penetration in uniform and nonuniform magnetic fields are analyzed. The efficiency of wave input for these conditions is calculated. Author (NSA)

N72-20716# Academy of Sciences (USSR), Leningrad. Fiziko-Tekhnicheskii Inst.
NONLINEAR EFFECT IN MICROWAVE ABSORPTION BY PLASMA
V. I. Arkhipenko, V. N. Budnikov, and A. A. Obukhov 1971 9 p refs In RUSSIAN
(NP-19072) Avail: AEC Depository Libraries

The experimental conditions were: a discharge tube 70 cm long and 2.5 cm in diameter was placed in a uniform magnetic field; the operating gas was argon; and plasma temperature was 3 to 10 eV. The discharge was maintained by absorption of 10-cm 150-W microwave power at magnetic fields higher than the cyclotron value. It was found that at power levels exceeding critical ones the microwave absorption also took place outside the transformation region. On increasing the power levels, the gap between the high-frequency transformation region and the middle one was narrowed and then closed. The phenomenon described can be accounted for by a decay instability.
Author (NSA)

N72-20717# Atomic Energy Commission, Washington, D.C.
DIFFUSION IN EXPERIMENTS ON HIGH-FREQUENCY STABILIZED PLASMA
L. V. Dubovoi and V. F. Shanskii [1971] 11 p refs Transl. into ENGLISH from RUSSIAN report NP-18145
(AEC-tr-7279; NP-18145) Avail: NTIS

The diffusion coefficient of charged particles was measured in order to determine the high frequency stabilization of the Kadomtsev-Nedospasov current-convective instabilities in electron hole plasma in germanium semiconductors. The diffusion coefficient was obtained on the basis of the spatial distribution of particles in plasma, measured by the method of free carrier absorption of He-Ne laser infrared emission. It is shown that the high frequency stabilization results in reduction of the anomalous diffusion coefficient down to the magnitudes close to those measured in the case of steady state plasma. Author (NSA)

N72-20718# Joint Publications Research Service, Washington, D.C.
RECORDING OF PLASMA OSCILLATIONS INDUCED BY EXTERNAL SUPERHIGH FREQUENCY FIELD
G. M. Batanov, K. A. Sarksyan, and V. A. Silin AEC [1971] 9 p refs Transl. into ENGLISH from the Russian report NP-18471
(AEC-tr-7280; NP-18471) Avail: NTIS

A probe is described for measuring potential plasma oscillations in the presence of intense external ultrahigh frequency fields. The probe is screened from the external UHF field by means of a section of open coaxial cable. Plasma oscillations induced in an inhomogeneous plasma layer by strong UHF waves were studied. Oscillations in the region omega sub zero approximately equal to omega sub Le were recorded. In the case of a strong external field in the region omega sub zero > omega sub Le i, the frequency of the plasma oscillation signal coincided with the frequency of the external radiation omega sub zero.
Author (NSA)

N72-20719# Joint Publications Research Service, Washington, D.C.
TURBULENT HEATING OF IONS IN SKINNED HIGH-FREQUENCY DISCHARGE
L. V. Dubovoi, V. A. Ivanov, and V. I. Chernobrovin AEC [1971] 18 p refs Transl. into ENGLISH from the Russian report NP-18187
(AEC-tr-7282; NP-18187) Avail: NTIS

A corpuscular diagnostics method was used for measuring energy spectra of ions in a strong HF discharge with skin current. The spectra revealed the presence of two groups of ions - the basic one with temperature of about 50 eV, and a small group with T approximately equal to 700 eV, at mean electron temperature in the plasma of about 100 eV. Both groups of ions are described by a Maxwell energy distribution function. Data obtained indicate that the flow of the plasma initial discharge stage is collision free, but the heating process of electrons and ions is turbulent. Results are in good agreement with the theory predicting plasma heating produced by the excitation in the skin layer region of the ion-acoustic microinstability. Author (NSA)

N72-20720# Joint Publications Research Service, Washington, D.C.
LINEAR TRANSFORMATION AND ABSORPTION OF WAVES IN PLASMA
V. E. Golant and A. D. Piliya AEC [1971] 70 p refs Transl. into ENGLISH from the Russian report NP-18504
(AEC-tr-7278; NP-18504) Avail: NTIS

The coupling of electromagnetic and plasma waves in the region of nonuniform plasma where the cold refractive index has a singularity is analyzed. The conditions for the transformation mechanism to become effective are discussed, and a survey of the results on the transformation effectiveness is given. Experimental results on collisionless absorption of the high-frequency waves in the frequency region between the upper and the lower hybrids are reviewed. Analysis of the experimental data and their comparison with theory indicates that the experimentally observed absorption is accounted for, in a wide variety of conditions, by the linear transformation of the incident electromagnetic wave into a strongly damping plasma wave. The collisionless absorption due to the transformation can be useful in plasma heating in experiments aimed at controlled thermonuclear fusion. Author (NSA)

N72-20721# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension
CONTROLLED FUSION AND PLASMA RESEARCH: A LITERATURE SEARCH
Milton O. Whitson, comp. Apr. 1971 476 p refs
(TID-3557-1970-Suppl) Avail: NTIS HC $6.00/MF $0.95

This search includes 2742 references on various aspects of plasma physics and controlled thermonuclear research. Report number, corporate author, and subject indexes are included.
Author (NSA)

N72-20722# Atomic Energy Commission, Washington, D.C.
SOME PECULIARITIES IN PLASMA FORMATION BY MICROWAVE DISCHARGES NEAR HARMONICS OF

ELECTRON CYCLOTRON FREQUENCY
V. N. Budnikov, K. M. Novik, and A. A. Obukhov Dec. 1971 7 p refs Transl. into ENGLISH of Russian report NP-18503 Akad. Nauk SSSR, Fiz.-Tekhn. Inst., Leningrad, 1970 p 1-11
(AEC-TR-7281; NP-18503) Avail: NTIS

Plasma formation by 3-cm microwave power in a magnetic field was studied. Plasma was created in a quartz tube 70 cm long and with diameter 2.5 cm (up to 700 W). The experiments were carried out in argon. The effect of high-frequency plasma spreading along the magnetic field at values corresponding to electron cyclotron harmonics was investigated. The measurements by double probes were made along the tube. Fast electron groups with energy about 100 eV were shown to exist. Their formation was associated with the absorption of incident wave energy in a small volume because of the large absorption coefficient of plasma waves in the vicinity of cyclotron harmonics. Author (NSA)

N72-20723# Stanford Univ., Calif. Inst. for Plasma Research.
THE EFFECTS OF CHANNEL SIZE ON THE IONIZATION INSTABILITY IN MHD GENERATORS Interim Report
Robert Michael Evans Aug. 1971 144 p refs
(Contract F44620-68-C-0051; AF Proj. 9752)
(AD-734786; SU-IPR-429; AFOSR-72-0021TR) Avail: NTIS CSCL 20/9

An experimental and theoretical study of the ionization instability in nonequilibrium, continuous-electrode MHD generators is presented. A linear-perturbation analysis was performed on a set of equations describing the free electrons and consisting of Ohm:s law, the electron energy equation, the Saha equation, Maxwell:s relations, and the boundary conditions suitable for continuous electrodes. Essential to the analysis is the retention of the radiation and heat conduction terms of the energy equation. The inclusion of the boundary conditions and the wavelength dependent terms (radiation and conduction) in the energy equation allow the prediction of the critical Hall parameter for various modes of the instability and the prediction of the wavelength having the largest growth rate. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-20724 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATIONSHIP OF THE DIELECTRIC STRENGTH OF POLYMER FILMS TO THE DIMENSIONS OF THE SPHERULITE STRUCTURE
S. N. Kolesov [1970] 7 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 9, 1970 p 84-88
(NLL-CE-Trans-5781-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

It is established that the dielectric strength of polymer films decreases linearly with increase in the dimensions of the spherulite structure, until the average diameter of the spherulites becomes approximately equivalent to the thickness of the film. A further increase in the size of the spherulites has virtually no effect on the dielectric strength. The results also indicate that during a breakdown on polymer film the discharge channel is formed predominantly in the interspherulite space, which has a looser structure. An empirical equation is derived for the relationship. Author

N72-20725*# Maryland Univ., College Park. Center for Theoretical Physics.
FLUCTUATION INDUCED CONDUCTIVITY OF SUPERCONDUCTORS ABOVE THE TRANSITION TEMPERATURE: REGULARIZATION OF THE MAKI DIAGRAM
Joachim Keller and Victor Korenman Jul. 1971 33 p refs (Grant NGR-21-002-008)
(NASA-CR-125795; TR-72-016) Avail: NTIS CSCL 20C

The Maki contribution to the conductivity above the superconducting transition temperature is regularized within the framework of the BCS theory. This is achieved through the renormalization of the impurity scattering vertex by inclusion of the effects of pair fluctuations. The conductivity is evaluated for a thin film. It depends only on the reduced temperature and the normal resistance per square. Fair agreement is found with Al films over a wide temperature range. Agreement is not found with experiments on Bi, Pb and Ga films, which apparently contain a strong additional pair-breaking effect. The temperature range in which interactions among fluctuations become important in the Maki conductivity is generally larger than that given by the Ginzburg criterion. Author

N72-20726# Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Physical Metallurgy.
THE EFFECT OF SILICA INCLUSIONS ON THE STRENGTHENING OF COPPER SINGLE CRYSTALS DURING PLASTIC DEFORMATION Ph.D. Thesis
Karri Vartianen Jul. 1971 101 p refs
Avail: NTIS

The influence of silica inclusions on the strengthening of copper single crystals was investigated by tensile testing at different temperatures using various strain rates. On the basis of the dislocation structures observed, suggestions for the possible glide and work hardening mechanisms were made. Investigations were carried out at various deformation stages: these involved rate, amount, and activation energy of recovery. Mechanisms for recovery taking place after straining, as well as for dynamic recovery, were suggested. Author

N72-20727# Technische Hochschule Munchen (West Germany).
SMALL ANGLE SCATTERING OF SUB-THERMAL NEUTRONS ON REACTOR IRRADIATED QUARTZ- AND COPPER-SINGLE CRYSTALS [KLEINWINKELSTREUUNG SUBTHERMISCHER NEUTRONEN AN REAKTORBESTRAHLTEN QUARTZ UND KUPFEREINKRISTALLEN]
Bernd Kaiser 1970 105 p refs In GERMAN
Avail: NTIS

Small angle scattering of subthermal neutrons to determine the structural defects in reactor irradiated copper and quartz crystals is discussed. The copper crystals received a dose of 6.07 times 10 to the 19th power fast neutrons per square centimeter with E greater than 1 keV. The quartz sample received various radiation dosages of the same magnitude. The radiation was conducted at 50 C to maintain the secondary defect agglomoration. Measurement of the small angle scattering on radiated quartz gave a progressive increase of scattering with radiation dosage. A similar dosage dependency was produced for the total effective cross section for subthermal neutrons and also for the thickness of the quartz sample. Transl. by P.N.F.

N72-20728# Technische Hochschule Munchen (West Germany).
POLARIZABILITY EFFECT ON EXCITON BONDS AT ISOELECTRIC PERTURBATION POINTS Ph.D. Thesis [EINFLUSS DER POLARISIERBARKEIT AUF DIE BINDUNG VON EXZITONENAN ISOELEKTRISCHEN STOERSTELLEN]
Joachim Bublath 1971 87 p refs In GERMAN
Avail: NTIS

A numerical analysis of the influence of polarizability on the bonds of excitation at the isoelectric perturbation points in crystalline structure is presented. The excitation theory is explained and mathematical models are included to support the theoretical considerations. The polarization coefficients for the disturbed crystal case are calculated. The disturbance potential and the binding energy in various crystals are determined. It is concluded that for crystalline structures with III - V type bonds, the effective mass of the holes (electron deficiency) has a greater effect than that of the electrons. Transl. by P.N.F.

N72-20729# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
REFLECTION AND SUPERIMPOSITION OF EWALD WAVES IN A SILICON CRYSTAL Ph.D. Thesis [REFLEXION UND UEBERLAGERUNG VON EWALDWELLEN IN EINEM SILIZIUMKRISTALL]
Klaus Lehmann 30 Oct. 1970 96 p refs In GERMAN
Avail: NTIS

The dynamic theory of X-ray interference fields is used to analyze symmetric Laue refractions of a high purity silicon crystal. It is shown that a large crystal thickness allows only the smallest X-ray wave field absorption to penetrate so that the strongly direction dependent absorption coefficient is reduced to its median part and easily measured. Partial deflection of the bundle from planar crystal sides produces intensity jumps in the reflected field waves and line structures that represent crystal layers of different thicknesses and absorption properties. Measurements on 27 different line distances are used to establish the atomic silicon formation amplitude of reflection on (220) as f = 8,64 at an accuracy of about 1%. Transl. by G.G.

N72-20730*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITE SUPERCONDUCTORS Patent Application
Gerald V. Brown, Willard D. Coles, and James C. Laurence, inventors (to NASA) Filed 16 Mar. 1972 10 p
(NASA-Case-LEW-11015-1; US-Patent-Appl-SN-235266) Avail: NTIS CSCL 20L

A method is described for producing a twisted, stabilized wire or tube superconductor, which can be used to wind electromagnets, armatures, rotors, field windings for motors and generators, and other magnetic devices which use a solenoid, toroidal, or other type winding. At least one groove is formed along the length of a wire substrate, which is then twisted into a helix; a layer of intermetallic superconducting material is thus formed in the groove. This layer may be formed by depositing the desired intermetallic compound into the groove, or by diffusing one component of the superconductor into the groove formed in a substrate composed of the other component. The superconductor prepared by this method comprises a nonsuperconducting wire twisted into the shape of a helix, with at least one groove containing a layer of superconducting material along the length of the wire. NASA

N72-20731*# Techtran Corp., Glen Burnie, Md.
EPITAXY: PHENOMENON OF POSTNUCLEATION, WITH DISCONTINUOUS THIN FILMS OF ALUMINUM AND GOLD ON (100) KC1 AS AN EXAMPLE
J. J. Metois, M. Gauch, A. Masson, and R. Kern Washington NASA Apr. 1972 20 p refs Transl. into ENGLISH of unpublished report "Phenomene de Postnucleation (sur l'Exemple des Couches Minces Discontinues d'Aluminum et d'Or sur (100) KC1)" Lab. de Mechanismes de la Croissance Cristalline, associated with CNRS, Provence Univ., Centre de St. Jerome, Marseilles, France, 1971
(Contract NASw-2037)
(NASA-TT-F-14217) Avail: NTIS CSCL 20L

It is shown experimentally that the formation process of an epitaxy has no connection with the heterogeneous nucleation process. The epitaxies (111) and (100) are set up by two different mechanisms: (1.) (111) by translational and rotational Brownian motion of small crystallites in the support's plane of contact and at moderate temperatures; and (2.) (100) by effective intercrystallite shocks resulting in coalescence at higher temperatures. When the condensation is on a hot support, all the processes (nucleation, Brownian migration, and shock coalescence) take place simultaneously. Author

N72-20732*# Techtran Corp., Glen Burnie, Md.
BROWNIAN MIGRATION OF CRYSTALLITES ON A SURFACE AND ITS RELATIONSHIP TO EPITAXY
R. Kern, A. Masson, and J. J. Metois Washington NASA Apr. 1972 19 p refs Transl. into ENGLISH from Surface Sci. (Netherlands), v. 27, 1971 p 483-498
(Contract NASw-2037)
(NASA-TT-F-14210) Avail: NTIS CSCL 20B

The terminal migration of small crystals on a crystalline substance is considered from two points of view. In the first, the surface self-diffusion of the atoms on the crystallites is assumed to be able to transport the crystallites. In the second, special atomic configurations located on the crystallite-substrate interface are assumed responsible for the motions. Both hypotheses are compared with experiment. The second theory is in qualitative agreement with the experiments. Author

N72-20733*# Scientific Translation Service, Santa Barbara, Calif.
REGULARITIES IN THE RECRYSTALLIZATION KINETICS OF METAL SINGLE CRYSTALS OF VARYING PURITY LEVEL
M. N. Belyakova and E. E. Zasimchuk Washington NASA Mar. 1972 20 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 31, no. 5, May 1971 p 982-993
(Contract NASw-2035)
(NASA-TT-F-14233) Avail: NTIS CSCL 20B

A statistical microstructural analysis was used for studying quantitatively the nucleation and growth kinetics of recrystallization nuclei as a function of purity and deformation. It is shown that the nucleation is hampered in single crystals so that the growth of nuclei is very slow during initial recrystallization stages. Impurities dissolved in the matrix do not change the general character of the recrystallization but substantially retard this process. Precipitates enhance the formation of the first recrystallization nuclei. The formation and growth rates of recrystallization nuclei increase with an increasing degree of deformation. Author

N72-20734# Technische Univ., Berlin (West Germany).
ELECTRON SPIN RESONANCE ON IONS WITH 3d(9) CONFIGURATIONS IN ZnO, ZnS- AND CdS-SINGLE Ph.D. Thesis [ELEKTRONENSPINRESONANZ AN LONEN MIT 3d(9)-KONFIGURATION IN ZnO-, ZnS UND CdS-EINKRISTALLEN]
Michael Schulz 1971 136 p refs In GERMAN
Avail: NTIS

Electron spin resonance of zinc oxide, zinc sulfide, and cadmium sulfide single crystals is discussed. The application of the Spin Hamilton Operator and the eigenvalues for computing the Spin Hamilton Operator are presented. Observations of the electron spin resonance for the various materials are explained by charts and graphs. Spin lattice relaxation reactions and the effects of temperature on such reactions are examined. Comparisons are made between the observed and calculated results. Transl. by P.N.F.

N72-20735# Electrotechnical Lab., Tokyo (Japan).
THE STABILITY OF COMPOSITE SUPERCONDUCTOR
Seijiro Ihara [1971] 96 p refs In JAPANESE; ENGLISH summary
(Rept-719) Avail: NTIS

An investigation was made of the stability criteria for a composite superconductor using theoretical as well as experimental methods, and the most reliable criteria were selected to optimize the dimensions of the conductor. A semigraphical method, which makes a quantitative analysis of the performances of terminal voltages possible, is described. Stability criteria are also derived, taking into account the effect of superconductor thickness and cooling conditions. The criterion is expressed as a function of the cryostatic stability and the dynamic stability. Author

N72-20736*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONITORING DEPOSITION OF FILMS Patent Application
James L. Zurasky, inventor (to NASA) Filed 18 Nov. 1971

10 p
(NASA-Case-MFS-20675; US-Patent-Appl-SN-200085) Avail: NTIS CSCL 20L

A system is described which uses the dual wavelength characteristics of light passing through a film during deposition to generate an output signal. The signal changes rapidly at the time when deposition should stop or change. Photodetectors are used to sense the light intensity changes at the two wavelengths, and the monitored signal represents the ratio of their sum and difference signal strengths. NASA

N72-20737# National Research Council of Canada, Ottawa (Ontario).
METHODS OF DETERMINING THE DEGREE OF ORDER OF NEMATIC CRYSTALLINE LIQUID LAYERS: THE DEGREE OF ORDER OF AZOXYANISOLE
A. Saupe and W. Maier 1972 22 p refs Transl. into ENGLISH from Z. Naturforsch. (West Germany), v. 16a, no. 8, 1961 p 816-824
(NRC-TT-1534) Avail: NTIS

Theoretical principles are discussed for determining the degree of long range order from measurements of diamagnetic susceptibility, index of refraction, dishroism, and proton resonance of nematic crystalline liquids. These methods were applied to measurements on p p prime-azoxyanisole, and the results of the various methods are compared with each other. Author

N72-20738# National Research Council of Canada, Ottawa (Ontario).
LUMINESCENCE AND ENERGY TRANSFER IN ORGANIC MOLECULAR CRYSTALS
H. C. Wolf 1972 42 p refs Transl. into ENGLISH from Festkoerperprobleme (West Germany), v. 4, no. 57-83, 1965
(NRC-TT-1517) Avail: NTIS

A survey of present knowledge is presented on fluorescence spectra and energy transfer processes in organic crystals, especially benzene, napthalene and anthracene. The most important crystal properties in the optical fluorescence spectra are Davydov splitting, and the occurrence of crystal-line (K-), molecular (M-) series and the X-series. X-fluorescence is a disturbed intrinsic fluorescence of the crystal. Both impurities and imperfections were observed as origins for this disturbance. Energy transfer processes in organic crystals are described by an exciton diffusion mechanism (hopping model). Author

N72-20739# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
SOLID STATE PHYSICS PROGRAM: THE ORIGINS OF STRESS IN THIN NICKEL FILMS Ph.D. Thesis
Frank Anthony Doljack Sep. 1971 106 p refs
(Contract AT(11-1)-623)
(COO-623-172; TR-76) Avail: NTIS

Intrinsic stress in thin, polycrystalline nickel films which were vapor deposited onto polished silicon substrates was measured by viewing the substrate deflection using an optical interference method. The method measured the force per unit width as a function of film thickness during film growth in high vacuum. The derivative of the force curve gave the instantaneous stress as a function of film thickness. Runs were made at controlled substrate temperatures between -42 C and 225 C by using a clamped substrate geometry which provided good thermal contact to a temperature-controlled body. Films were deposited at normal incidence and at 20, 30, and 40 deg incidence. Samples were stripped from their substrates, and since they were all approximately 2000 A thick, a 650 kV electron microscope was used to observe the microstructure. The instantaneous stress in the films was found to be constant except for the development of compressive stresses in the first 500 to 1000 A of growth at the higher substrate temperatures. Author

N72-20740# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM: THE DIELECTRIC PROPERTIES OF SOME ALKALI HALIDES
John Joseph Fontanella Jan. 1971 104 p refs
(Contract AT(11-1)-623)
(COO-623-165; TR-69) Avail: NTIS

Room temperature static dielectric constants and their pressure and temperature derivatives for LiF, NaF, NaCl, NaBr, KCl, and KBr are reported. The static dielectric constants were measured to an accuracy of 0.01% by the method of substitution. The results are used to discuss the validity of the various microscopic models of the static dielectric constant of ionic crystals. First, second, and third order pressure derivatives were measured to estimated accuracies of 0.2, 2, and 20%, and first and second order temperature derivatives were determined with uncertainties on the order of 0.3 and 30% using highly refined capacitance techniques. The results are discussed in terms of the temperature-independent volume derivative of the Szigeti effective charge and the volume-independent temperature derivative of the static dielectric constant. Author

N72-20741# California Univ., Berkeley. Lawrence Radiation Lab.
IMPORTANCE OF GEOMETRIC STATISTICS TO DISLOCATION MOTION
Dale Klahn, Don Austin, Amiya Mukherjee, and John E. Dorn Jul. 1971 61 p refs Presented at the Symp. on Statist. and Probabilistic Probl. in Met., Seattle, 4-6 Aug. 1971
(Contract W-7405-eng-48)
(LBL-130; Conf-710823-1) Avail: NTIS

A brief discussion is given on possible analytical approaches to the statistical problem of dislocation motion past dispersed localized obstacles. Author

N72-20742# Clemson Univ., S.C. Dept. of Physics.
RADIATION EFFECTS IN CRYSTALLINE MATERIALS Final Report
R. L. Chaplin 1971 32 p refs
(Contract AT(40-1)-3098)
(ORO-3098-14) Avail: NTIS

Studies were made of the effects of low energy electron irradiations (up to 0.5 MeV) on Al, Mg, Cu, and Ti. Measurements were made of the rates of defect production, threshold energy for atomic displacements, recovery, and changes in electric resistivity per unit defect concentration. NSA

N72-20743# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid States Physics.
LATTICE THERMAL CONDUCTIVITY AND HIGH-FIELD ELECTRICAL AND THERMAL MAGNETOCONDUCTIVITIES OF TUNGSTEN
D. K. Wagner Jun. 1971 52 p refs
(Contract AT(30-1)-2150)
(NYO-2150-75; Rept-1577) Avail: NTIS

Results of measurements of the high-field transverse electric and thermal conductivities of a high-purity tungsten single crystal are presented for the temperature range 1.5 to 6 K. The magnetic field dependences of the conductivities conform to the predictions of high-field semiclassical magnetoresistance theory, provided thermal conduction by the lattice is taken into account. The temperature dependence of the high-field electric conductivity, and the corresponding electronic contribution to the thermal conductivity were also measured. Theoretical expressions for these quantities are derived from semiclassical magnetoresistance theory, allowing estimates to be made of the temperature dependence associated with possible low-temperature scattering mechanisms. Difficulties in interpreting previous zero-field measurements in terms of electron-electron or electron-phonon scattering are discussed. Author (NSA)

N72-20744# Brookhaven National Lab., Upton, N.Y. Technical Information Div.
EFFECT OF PRESSURE ON SUPERCONDUCTIVITY IN

TRANSITION METALS
D. I. Khomskii Jun. 1971 8 p refs Transl. into ENGLISH from Kratk. Soobshch. Fiz. (Moscow), no. 6, Jun. 1971 p 3-19
(BNL-tr-453) Avail: NTIS

The effect of pressure on superconductivity in transition metals was investigated on the basis of experimental data and recently completed theoretical investigations. NSA

N72-20745# Minnesota Univ., Minneapolis. Inst. of Technology.
EXPERIMENTAL AND THEORETICAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS Annual Progress Report, 1971
Sep. 1971 59 p refs
(Contract AT(11-1)-1569)
(COO-1569-81) Avail: NTIS

Topics of research in low temperature and solid state physics are considered. These include: (1) nuclear magnetic resonance spectra of chromium and cobalt, and effects of impurities; (2) cobalt and helium isotopes; (3) quantum mechanics and crystal theory; (4) gold and copper alloys; (5) pair-field susceptibility and fluctuations in superconducting junctions and films; and (6) superfluid circulation quantization and a Josephson effect analog. K.P.D.

N72-20746# Minnesota Univ., Minneapolis.
FLUCTUATION BROADENING OF THE SUPERCONDUCTING STATE OF Nb.88Ti.12N THIN FILMS Ph.D. Thesis
Frederick Michael Schaer Dec. 1971 175 p refs Supported by AEC
(COO-1569-85) Avail: NTIS

Measurements of resistance of short mean free path Nb.88Ti.12N thin films are reported. Evidence for fluctuation conductivity was found at temperatures at least twice the 11 K transition temperature. In the upper part of the transition, there is qualitative agreement with the fluctuation conductivity calculation by Aslamasov and Larkin. NSA

N72-20747# Oak Ridge National Lab., Tenn.
PHONON SPECTRA AND SUPERCONDUCTIVITY IN SOME TRANSITION AND ACTINIDE METAL CARBIDES
Harold G. Smith 1971 18 p refs Presented at the Conf. on Superconductivity in d and f Band metals, Rochester, N. Y., 29 Oct. 1971
(Conf-711027-1) Avail: NTIS

Phonon dispersion curves were measured by inelastic neutron scattering for the carbides of the transition metals Ta, Hf, Nb, V, and Zr, in which unusual features are observed in some modes for those compounds that become superconducting (TaC,NbC). Studies made at temperatures immediately above and below the transition temperature in TaC did not reveal any changes in phonon frequency or width. Although $NbC_{0.76}$ (not superconducting above 1.2 K) does not show the changes of modes seen in $NbC_{0.98}$, some of the phonon spectra are extremely broad and asymmetric. This may be related to the highly defective nature of the crystal. The results corroborate the suggestion for the transition metals that the electron-phonon coupling constant, and hence the transition temperature, is sensitive to phonon frequencies in the strong-coupled superconductors. Author (NSA)

N72-20748# Sandia Labs., Albuquerque, N.Mex.
COMPARISON OF NUMERICAL TECHNIQUES FOR WAVE PROPAGATION PROBLEMS IN SOLIDS
B. J. Thorne and D. A. Dahlgren Nov. 1971 215 p Sponsored by AEC
(SC-RR-70571) Avail: NTIS

The comparison of four numerical methods for one-dimensional hydrodynamics on seven test problems indicates that the Lax-Wendroff two-step method outperforms the von Neumann-Richtmyer method, the method of S. K. Godunov, and an implicit method. A consideration of the amount of computation time required for a given accuracy shows that differences in accuracy between the von Neumann-Richtmyer and Lax-Wendroff methods can give large differences in computational efficiency. The main source of errors in the von Neumann-Richtmyer method is overdamping by the artificial viscosity, while the Lax-Wendroff method suffers from an overshoot at the shock and inadequate damping behind the shock. The form of the Lax-Wendroff method used here fails to converge on a shock problem due to the inadequate damping. Author

N72-20749# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
RADIATION EFFECTS ON IONIC CRYSTALS [LES EFFETS D'IRRADIATION SUR LES CRISTAUX IONIQUES]
Gerard Lobier Oct. 1971 48 p refs In FRENCH
(CEA-BIB-196) Avail: AEC Depository Libraries

The effects of radiation on ionic crystals are reviewed, with particular emphasis on alkali halides with fcc structures. The following topics are presented: the effects of radiation on optical, mechanical, and transport properties; the study of basic mechanisms postulated to explain point defect formation; and experiments on rare gas diffusion in ionic crystals exposed to neutrons. Author (NSA)

N72-20750# Cornell Univ., Ithaca, N.Y.
ON CONTRAST PATTERNS PRODUCED BY SELF-INTERSTITIAL ATOMS IN FIELD ION MICROSCOPE IMAGES OF A BCC METAL
D. N. Seidman and K. H. Lie 25 Jul. 1971 32 p refs
(Contract AT(30-1)-3504-60)
(NYO-3504-60; Rept-1598) Avail: NTIS

A general method is presented for calculating the contrast pattern expected from a single self-interstitial atom (SIA) in a field ion microscope (FIM) image. It was assumed that the SIA was embedded inside a FIM specimen well below the surface. Three possible contrast effects were: (a) a bright spot; (b) an extra bright spot; and (c) a vacant lattice site. A single SIA atom can produce all these contrast effects, and the totality of these effects was termed a contrast pattern. Detailed atomic displacement maps are presented. The maps contain sufficient information to allow the configuration of the SIA to be determined. A local field enhancement factor was calculated and converted to an extra ion current via data on the ion current versus electric field characteristic curves of individual planes. Application of these principles was presented for an SIA contrast pattern detected in a (111) plane of tungsten irradiated with 20 keV W(+) ions at 18 K. This contrast pattern contained the three contrast effects suggested by the model. Author

N72-20751# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
CRITIQUE OF RECENT THEORIES AND MONTE CARLO CALCULATION OF EXCHANGE IN SOLID He-3
A. K. McMahan 1971 153 p refs
(Contract AT(11-1)-1569)
(COO-1569-84) Avail: NTIS

A theory of exchange in solid He-3 is discussed, which yields general expressions for the matrix elements of the exchange operator. The theory constitutes an extension of work on electronic exchange. The expressions for the matrix elements of the exchange operator appear as many-body integrals. A test of theory approximation using two-body integrals is reported. The $T = 0$ nearest neighbor exchange frequency was calculated by Monte Carlo integration of the full many-body surface integral expression, using the Nosanow-type wave function. It is concluded that many-body short range correlation effects are important to the exchange process. Author

N72-20752# California Univ., Livermore. Lawrence Radiation Lab.
DOMAIN BOUNDARY CONFIGURATION FOR HEAD-ON MAGNETIZATION IN THIN FILMS
E. J. Hsieh and R. F. Soohoo 15 Oct. 1971 5 p refs

Presented at 17th Ann. Conf. on Magnetism and Magnetic Mater., Chicago, 16-19 Nov. 1971 Sponsored by AEC
(UCRL-73335; Conf-711108) Avail: NTIS

Observations and calculations were made of the configuration of domain boundaries between two regions of head-on magnetization. The boundary between such regions is zigzag in shape, with the zigzag angle theta varying between 15 and 60 deg in the case of Permalloy films of varying composition and thickness. The energy of the wall can be expressed as a function of theta. An expression for the equilibrium angle theta sub zero is given. Author

N72-20753# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
CUPROUS SULFIDE AND CUPROUS SULFIDE-CADMIUM SULFIDE HETEROJUNCTIONS Interim Report
M. Neuberger Sep. 1971 62 p refs
(Contract DSA900-72-C-1182)
(AD-734536; EPIC-IR-69-Rev) Avail: NTIS CSCL 20/12

Fifty-six extracts of documents which provide information on cuprous sulfide and cuprous sulfide-cadmium sulfide from the Electronic Properties Information Center storage and retrieval system are provided. Considerable mineralogical information as well as phase diagrams, physical properties and photovoltaic properties are included. Author (GRA)

N72-20754# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
GALLIUM ARSENIDE: A BIBLIOGRAPHIC SUPPLEMENT
Nov. 1971 58 p refs
(Contract DSA900-72-C-1182)
(AD-734598; EPIC-SB-2) Avail: NTIS CSCL 20/12

Two hundred sixty-eight citations and abstracts are given on the electronic, optical, thermal, and mechanical properties of gallium arsenide. Author (GRA)

N72-20755# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
LOW TEMPERATURE SPECTROSCOPY OF SOLIDS FOR ELECTROMAGNETIC SENSING DEVICE Final Report
Robert G. Heller Nov. 1971 7 p refs
(Grant AF-AFOSR-1506-68; AF Proj. 9763-02)
(AD-733748; AFOSR-71-2978TR) Avail: NTIS CSCL 20/12

The quasi-particle description formed the basis for experimental interpretation of the spectra of a broad range of crystals. Phono, magnon and electronic excitations were observed and interpreted. The studies on surface quantization of metal oxide semiconductor surfaces suggested a different family of infrared devices. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-20756*# Fairchild Industries, Inc., Farmingdale, N.Y. Fairchild-Republic Div.
PROPELLANT SIDEFEED-SHORT PULSE DISCHARGE THRUSTER STUDIES
Dominic J. Palumbo and William J. Guman Jan. 1972 66 p refs
(Contract NAS1-10944)
(NASA-CR-112035; PCD-TR-72-1; FHR-4031A; PC004R9401) Avail: NTIS CSCL 21I

The technique of feeding a solid propellant into the discharge from the sides of the discharge was evaluated. The thrust/power ratio could be significantly effected by the included angle of V-shaped propellants and by the electrode length. This result implies that when results are compared at the same specific impulse it is possible to obtain higher thrust efficiencies. In particular, it was found that for a given discharge energy the thrust/power ratio correlated with propellant mass. Increasing the integral simultaneously increases both the gas dynamic and electromagnetic thrust. An analytic expression was formulated for ablated mass which comprehensively describes experimental data in terms of geometry and electrical parameters. The correlation of the product impulse x specific impulse with discharge energy was also described. It is suggested that the reliability of dry energy storage capacitors does not equal the reliability of liquid impregnated units when the comparison is made at the same joules/Kg rating. Author

N72-20757*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
LIQUID-PHASE MIXING OF BIPROPELLANT DOUBLETS
F. W. Hoehn, J. H. Rupe, and J. G. Sotter 15 Feb. 1972 30 p refs
(Contract NAS7-100)
(NASA-CR-125915; JPL-TR-32-1546) Avail: NTIS CSCL 21I

Experimental results of unlike doublet mixing are correlated with an analytically derived equation predicting fluid cavitation. The correlation relates the minimum orifice pressure drop required to initiate cavitation, with the system back pressure, cold flow simulant vapor pressure, and the orifice flow discharge and contraction coefficients. Stream flow instabilities are also visually correlated with the onset of cavitation and orifice discharge coefficient measurements. The influence of cavitation on the characteristic phenomenon of hydraulic flip is observed for both circular and noncircular shaped orifices. For certain intermediate orifice lengths, some noncircular shapes are shown to produce more fully developed flows (shorter recovery lengths) and therefore a more cohesive jet, which in turn yields slightly higher cold flow mixing uniformities than circular shaped orifices of equal absolute length. The particular noncircular shaped elements evaluated are shown to be more sensitive to liquid stream misimpingement than the corresponding circular orifices. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-20758* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ROCKET MOTOR Patent
Floyd A. Anderson, inventor (to NASA) Issued 25 Jan. 1972 6 p Filed 16 Jul. 1968
(NASA-Case-XNP-03282; US-Patent-3,636,711; US-Patent-Appl-SN-745337; US-Patent-Class-60-254) Avail: US Patent Office CSCL 21H

A solid propellant rocket motor is provided with a venting system, which is used to control the motor's effective nozzle throat area. By controlling the nozzle throat area, the motor's ratio of free chamber volume to nozzle throat area is controlled, thereby controlling the motor's combustion extinction pressure, which determines whether the motor is in a stable or unstable combustion zone. Official Gazette of the U.S. Patent Office

N72-20759*# Aerojet Liquid Rocket Co., Sacramento, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER. VOLUME 1: EXECUTIVE SUMMARY Final Report
18 Jan. 1972 27 p

(Contract NAS8-28217)
(NASA-CR-123538) Avail: NTIS CSCL 21H

The activities leading to a tentative concept selection for a pressure-fed engine and propulsion support are outlined. Multiple engine concepts were evaluted through parallel engine major component and system analyses. Booster vehicle coordination, tradeoffs, and technology/development aspects are included. The concept selected for further evaluation has a regeneratively cooled combustion chamber and nozzle in conjuction with an impinging element injector. The propellants chosen are LOX/RP-1, and combustion stabilizing baffles are used to assure dynamic combustion stability. N.E.N.

N72-20760*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
APPLICATION OF THE GALERKIN METHOD IN THE DESIGN OF STABLE LIQUID ROCKET MOTORS Semiannual Report, 1 Aug. 1971 - 31 Jan. 1972
Ben T. Zinn, Eugene A. Powell, Manuel E. Lores, and S. Kalyanasundaram 6 Mar. 1972 46 p refs
(Grant NGL-11-002-083)
(NASA-CR-125818; SAR-7) Avail: NTIS CSCL 21H

A brief description of results obtained in the continuing investigations is presented. The following areas are covered: (1) the development of the third-order, multimode theory to study the behavior of large amplitude transverse instabilities, (2) nonlinear axial mode instability, and (3) the influence of the functional form of the unsteady combustion response function upon the stability characteristics of rocket motors. Also a study was begun to improve the second order potential theory in order to provide a better approximation to the nozzle boundary condition. Author

N72-20761*# TRW Systems Group, Redondo Beach, Calif.
SPACE STORABLE INTER-REGEN DESIGN STUDY Final Report
R. M. Williams 30 Jan. 1970 167 p
(Contract NAS3-12059)
(NASA-CR-72647; TRW-13463-6001-R0-00) Avail: NTIS CSCL 21H

The space storable inter-regen design study was a six-month analytical and experimental investigation for evaluating selected internally regenerative (inter-regen) cooled RCS thruster design variables using the space storable propellant combination, FLOX/propane. Several injector and thrust chamber design variables were evaluated at selected coolant flow rates to demonstrate steady state thruster operation with minimum performance degradation. Through the use of a ducted coolant thrust chamber design, steady state thermal operation was achieved with metallic (copper) chamber designs, during two test firings of 90- and 310-second durations. Author

N72-20762*# Aerojet Solid Propulsion Co., Sacramento, Calif.
DEMONSTRATION OF A STERILIZABLE SOLID ROCKET MOTOR SYSTEM, ADDENDUM Final Report
D. O. DePree and W. L. Lambert Dec. 1971 68 p ref
(Contract NAS1-10086)
(NASA-CR-111889A) Avail: NTIS CSCL 21H

Technical emphasis was placed on characterization of a scaled-up batch of the improved propellant formulation and determination of the effects of dry heat sterilization on propellant integrity and structural response. The grain stress analysis was directed toward tailoring a fully-bonded grain to the calculated propellant allowable stresses and investigating various bond release concepts to relieve stresses incurred in thermal shrinkage following sterilization. Author

N72-20763*# Pratt and Whitney Aircraft, East Hartford, Conn.
TWO STAGE FAN. 1: AERODYNAMIC AND MECHANICAL DESIGN
H. E. Messenger and E. E. Kennedy Jan. 1972 138 p refs
(Contract NAS3-13494)
(NASA-CR-120859; PWA-4148) Avail: NTIS CSCL 21E

A two-stage, highly-loaded fan was designed to deliver an overall pressure ratio of 2.8 with an adiabatic efficiency of 83.9 percent. At the first rotor inlet, design flow per unit annulus area is 42 lbm/sec/sq ft (205 kg/sec/sq m), hub/tip ratio is 0.4 with a tip diameter of 31 inches (0.787 m), and design tip speed is 1450 ft/sec (441.96 m/sec). Other features include use of multiple-circular-arc airfoils, resettable stators, and split casings over the rotor tip sections for casing treatment tests. Author

N72-20764# Council for Scientific and Industrial Research, Pretoria (South Africa).
WANKEL ENGINES FOR AIRCRAFT
J. Falecki Feb. 1971 10 p refs Transl. into ENGLISH from Tech. Lotnicza i Astronaut. (POLAND), v. 24, no. 6, 1969 p 12-15
(Rept-908) Avail: NTIS

The Wankel engine is compared with conventional and jet aircraft engine for application to light aircraft propulsion. The characteristics of the engines for light aircraft and helicopters are presented. The advantages of the Wankel engine from the standpoint of simplicity, smooth operation, power output, and fuel consumption are examined. Graphs are presented to show the comparative performance of the engines for power output, specific fuel consumption, cost and effects of altitude on power output. Author

N72-20765# Council for Scientific and Industrial Research, Pretoria (South Africa).
CRITICAL EXAMINATION OF THE PULSE-JET
Rodolfo Pallabazzer Nov. 1970 35 p refs Transl. into ENGLISH from Monografie Sci. E Tech. (Italy), no. 27, 1966 p 1-29
(Rept-891) Avail: NTIS

A reexamination of the pulsejet from the thermodynamical and geometrical standpoint is presented. Several suggestions are given for the study of new geometries by means of the theory of characteristics. Ideas are considered for the definition and improvement of two kinds of pulsejets with afterburner and double exhaust. Author

N72-20766*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ION THRUSTER WITH A COMBINATION KEEPER ELECTRODE AND ELECTRON BAFFLE Patent Application
Eugene V. Pawlik and Dennis J. Fitzgerald, inventors (to NASA) Filed 20 Dec. 1971 12 p
(Contract NAS7-100)
(NASA-Case-NPO-11880; US-Patent-Appl-SN-209535) Avail: NTIS CSCL 21C

An ion thruster is described in which the cathode front end, surrounded by an insulator, is mounted flush with the front end of the flanged portion of the cathode pole piece. The thruster's baffle, positioned in front of the cathode's front end, supports the thruster's keeper electrode, which is spaced apart and directed toward the cathode's open end. The baffle is at the keeper's electrode potential. NASA

N72-20767*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLEXIBLE FIRE RETARDANT FOAM Patent Application
John A. Parker and Salvatore R. Riccitiello, inventors (to NASA) Filed 21 Apr. 1971 12 p
(NASA-Case-ARC-10180-1; US-Patent-Appl-SN-136253) Avail: NTIS CSCL 11D

A lightweight fire resistant plastic foam has been developed to provide thermal protection to reentry vehicles and aircraft structures. Neoprene-isocyanate foams were modified by the addition of from 10 to 30% by weight of a polymeric alkyl halide. The solid foam can be made by conventional systems and it is only necessary to add finely dispersed alkyl halide to the neoprene latex during normal processing. NASA

N72-20768*# Colorado State Univ., Fort Collins.
STABILITY OF COMBUSTORS WITH PARTIAL LENGTH ACOUSTIC LINERS
C. E. Mitchell, W. R. Espander, and M. R. Baer Mar. 1972 73 p refs
(Grant NGR-06-002-095)
(NASA-CR-120889) Avail: NTIS CSCL 21H

An analytical technique for the evaluation of combustion stability in rocket motors with partial length acoustic absorbers is presented. The combustors considered have concentrated combustion zones at the injector, finite mean flows, cylindrical cross sections, and acoustic liners of arbitrary length and impedance. Linear three dimensional oscillations in such combustion chambers are analyzed using an integral equation-iteration technique. Stability limits in terms of a combustion response factor are calculated for several values of Mach number, length to radius ratio, liner impedance, liner length, liner location, and nozzle admittance. Results indicate that increasing liner length increases combustor stability substantially at low Mach numbers but has a substantially smaller effect for larger Mach numbers. Increasing Mach numbers or length to radius ratio have destabilizing effects while liner location has only a minor effect on stability. Author

N72-20769*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERSONIC COMBUSTION ROCKET Patent Application
Richard J. Weber and Leo C. Franciscus, inventors (to NASA) Filed 10 Mar. 1972 8 p
(NASA-Case-LEW-11058-1; US-Patent-Appl-SN-233519) Avail: NTIS CSCL 21H

A supersonic combustion rocket is described in which large turbopumps for fuel and oxidizers are eliminated by the use of a small rocket motor upstream of the mixing chamber. The exhaust from the small rocket motor creates a pressure differential between the storage tanks for the fuel and oxidizers and the mixing chamber which causes the propellant components to flow from the tanks to the chamber. As the propellant passes the small rocket motor, it becomes entrained in the exhaust gases and may enter the mixing chamber at supersonic speeds. The proposed system results in a rocket motor having substantially greater efficiency than a motor of the same size using a turbopump feed system. NASA

N72-20770*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERSONIC FAN BLADING Patent Application
Arthur W. Goldstein, inventor (to NASA) Filed 21 Jan. 1972 9 p
(NASA-Case-LEW-11402-1; US-Patent-Appl-SN-219806) Avail: NTIS CSCL 21E

A transonic propulsion fan for a turbofan engine is described which was designed to propagate a minimum noise distribution in a forward direction. The fan consists of radially extended rotor blades mounted on a hub so that the peripheral spacing of the blades prevents the formation of a channel or passageway between adjacent blades. Each blade has a flat trailing surface extending for the leading edge at least as far to the rear as to cause any pressure waves which might originate on the blade surface to strike the leading surface of the following blade rather than propagate upstream of the blade row. The flat trailing surface of each blade makes an angle with the axis of rotation such that the blade is parallel to a gas inflow into the blades. NASA

N72-20771*# Radio Corp. of America, Lancaster, Pa.
THERMAL FLUX TRANSFER SYSTEM Patent Application
Robert Alfred Freggens, inventor (to NASA) Filed 16 Jun. 1971 20 p
(Contract NAS7-697)
(NASA-Case-NPO-12070; US-Patent-Appl-SN-153542) Avail: NTIS CSCL 21H

A thermal flux transfer system is described for use in maintaining the thrust chamber of an operative reaction motor at given temperatures. The system is characterized by a hermetically sealed chamber surrounding a thrust chamber to be cooled and seated within, a number of parallel, longitudinally spaced, disk-shaped wick members formed of a metallic mesh. These are employed to deliver a working fluid, in its liquid state, the thrust chamber and subsequently deliver the working fluid, in its vapor state, away from the nozzle, thereby effecting a cooling of the nozzle. NASA

N72-20772# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Abrielung Fluessigkeitstriebwerke.
BORON COMBUSTION CHARACTERISTICS IN DUCTED ROCKETS
Klaus Schadow 1971 30 p refs
(DLR-FB-71-59) Avail: NTIS; DFVLR, Porz: 10 DM

A test program was performed for experimentally investigating the boron reaction characteristics in a ducted rocket by systematically varying the primary chamber conditions. A test device was used which burned boron powder and gaseous propellants. At primary motor conditions which are similar to propellants with high boron and low oxidizer fuel content the boron particle temperature at the primary nozzle exit was not sufficient to start self-sustained boron combustion in the air. Additional gaseous fuel was necessary to further heat up the boron particles in the secondary chamber. It was demonstrated that the gaseous fuel ignition in the air was triggered by the hot (probably reacting, but not vigorous burning) boron particles. Author (ESRO)

N72-20773# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antriebe.
HEATING OF A GAS GENERATOR IN A RAMJET ROCKET DURING WIND-TUNNEL TESTS [UEBER DIE AUFHEIZUNG EINES GASGENERATORS IN EINER STAUSTRAHLRAKETE BEI WINDKANALVERSUCHEN]
Reiner Lindemann 1971 23 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-79) Avail: NTIS; DFVLR, Porz: 8,50 DM

The temperature rise of the solid grain and its igniter were investigated. The gas generator was inside the spike of the ramjet inlet-diffuser and was heated by the air flowing through the engine. The 200 mm diameter research engine was operated in the wind tunnel for 1 minute at free stream Mach 2.5. The measurements did not show an inadmissable high heating rate during the run. The temperatures reached after the tests necessitate some precautions concerning the operation of the ram rocket model in the wind tunnel. Author (ESRO)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-20774*# Techtran Corp., Glen Burnie, Md.
PHYSICS OF ELEMENTARY PARTICLES AND COSMIC RAYS
S. A. Azimov, ed. Washington NASA Mar. 1972 134 p refs Transl. into ENGLISH of the book "Fizika Elementarnykh Chastits i Kosmicheskikh Luchey" Tashkent, Fan Press, 1969
(Contract NASw-2037)
(NASA-TT-F-686) Avail: NTIS CSCL 03B

Results are presented of theoretical and experimental studies of elastic and inelastic collisions of strongly interacting elementary cosmic particles at high energies. For individual titles, see N72-20775 through N72-20783.

N72-20775*# Techtran Corp., Glen Burnie, Md.
INTEGRAL REPRESENTATIVES OF SCATTERING AMPLITUDE
G. G. Arushanov *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 1-44 refs (See N72-20774 11-29)
Avail: NTIS CSCL 03B

Several integral representations of scattering amplitude are discussed. Those included are based on the Kobson formula, the Hankel transform, the Mailer-Dirichlet integral, the Fourier transform and the legendre polynomials. Author

N72-20776*# Techtran Corp., Glen Burnie, Md.
TWO PARTICLE INELASTIC REACTION WITH EXCHANGE OF A BARYON HAVING SPIN OF 3/2 c24
Ye. V Beter and Yu. G. Gulyamov *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 45-47 (See N72-20774 11-29)
Avail: NTIS CSCL 20H

A formula is developed for the differential cross section of a reaction involving baryon exchange. The model for the calculations which are performed in the first order of the perturbation theory is shown in a Feynman diagram. F.O.S.

N72-20777*# Techtran Corp., Glen Burnie, Md.
INELASTIC NEGATIVE PION p-INTERACTIONS WITH SMALL MOMENTUM TRANSFER c24
S. A. Azimov, Kh. A. Rizayev, and A. A. Yuldashev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 48-58 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

The results of an investigation of several aspects of inelastic negative pion-proton interactions with low momentum transfer are presented. The following distributions are shown in graphs: momentum of secondary protons, secondary negative ions, energy of gamma-Quanta, and angular distribution of gamma-Quanta. F.O.S.

N72-20778*# Techtran Corp., Glen Burnie, Md.
INELASTIC pp-INTERACTIONS AT AN ENERGY OF 6 GeV WITH LOW MOMENTUM TRANSFER c24
S. A. Azimov, Yu. G. Gulyamov, and B. G. Rakhimbayev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 59-64 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

A study of peripheral pp-interactions using an isobaric model and a model of single-pion exchange indicates that the dual origin of isobars increases markedly in the 6-9 GeV energy range. Author

N72-20779*# Techtran Corp., Glen Burnie, Md.
INTERACTION OF 30.8 GeV/c PROTONS WITH HEAVY EMULSION NUCLEI IN A STRONG MAGNETIC FIELD c24
S. A. Azimov, Yu. G. Gulyamov, N. M. Myalkovskaya, A. L. Svechnikova, L. P. Chernova, and G. M. Chernov *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 65-79 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

Results are presented of an experimental investigation of the properties of secondary shower particles generated in interactions of high energy protons with heave nuclei of photographic emulsions. The results indicate that: (1) An overwhelming majority of charged shower particles are pions and protons. (2) All kinematic and dynamic characteristics of positive and negative pions in all groups of showers are the same within the limits of error of the experiment. (3) Protons in the laboratory system of reference escape at smaller angles than the pions. F.O.S.

N72-20780*# Techtran Corp., Glen Burnie, Md.
INTERACTION OF PROTONS WITH ENERGIES IN TENS OF GeV WITH HEAVY EMULSION NUCLEI AND A MODEL OF THE INTRANUCLEAR CASCADE c24
S. A. Azimov, Yu. G. Gulyamov, L. P. Chernova, and G. M. Chernov *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 80-84 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

The experimental results of studies of proton-nucleus interaction using photographic emulsions in a strong magnetic field are presented, with calculations based on a model of the intranuclear cascade. Author

N72-20781*# Techtran Corp., Glen Burnie, Md.
PERSPECTIVES FOR INVESTIGATIONS OF CHARACTERISTICS OF NUCLEAR INTERACTIONS AT ENERGIES OF 10 TO THE ELEVENTH POWER THROUGH 10 TO THE THIRTEENTH eV ON THE LARGE INSTALLATION AT THE HIGH ALTITUDE STATION KUM-BEL OF THE INSTITUTE OF NUCLEAR PHYSICS OF THE ACADEMY OF SCIENCES OF THE UZBEK SSR c24
A. M. Abdullayev, S. A. Azimov, Kh. Zaynutdinov, E. Mulladzhanov, V. M. Myalkovskiy, and T. S. Yuldashbayev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 85-100 refs (See N72-20774 11-29)
Avail: NTIS CSCL 20H

A device for studying the characteristics of nuclear interactions, located at the Kum-Bel high-altitude station, is described in detail. The method of its use for determining the effective cross-section of elastic interaction, the angular distribution of shower particles, and its use in investigating other phenomena are presented. Author

N72-20782*# Techtran Corp., Glen Burnie, Md.
USE OF SPARK CHAMBERS WITH A HIGH EFFECTIVE AREA FOR COSMIC RAYS
A. M. Abdullayev, S. A. Azimov, V. M. Gorbovskiy, D. A. Talipov, and T. S. Yuldashbayev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 101-108 refs (See N72-20774 11-29)
Avail: NTIS CSCL 03B

A spark chamber using pure helium as the working gas and having a large effective area is described. Joint use of a photographic recording system is discussed. Author

N72-20783*# Techtran Corp., Glen Burnie, Md.
CERENKOV DETECTORS WITH HIGH EFFECTIVE AREA c14
A. M. Abdullayev, S. A. Azimov, E. Mulladzhanov, A. Sadykov, and T. S. Yuldashbayev *In its* Phys. of Elementary Particles and Cosmic Rays Mar. 1972 p 109-115 refs (See N72-20774 11-29)
Avail: NTIS CSCL 14B

The significance of such factors as the reflectivity of the inner surface and the use of spectrum-shifting substances on the function of a Cerenkov detector is examined. Author

N72-20784*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTOCHEMISTRY OF INTERSTELLAR MOLECULES
L. J. Stief Dec. 1971 27 p refs Presented at the Symp. on Interstellar Molecules, Charlottesville, Va., Oct. 1971
(NASA-TM-X-65854; X-691-71-476) Avail: NTIS CSCL 03B

The photochemistry of two diatomic and eight polyatomic molecules is discussed quantitatively. For an interstellar molecule, the lifetime against photodecomposition depends upon the absorption cross section, the quantum yield or probability of dissociation following photon absorption, and the interstellar radiation field. The constant energy density of Habing is used for the unobserved regions of interstellar radiation field, and the field in obscuring clouds is estimated by combining the constant flux with the observed interstellar extinction curve covering the visible and ultraviolet regions. Lifetimes against photodecomposition in the unobscured regions and as a function of increasing optical thickness in obscuring clouds are calculated for the ten

species. The results show that, except for CO, all the molecules have comparable lifetimes of less than one hundred years. Thus they can exist only in dense clouds and can never have been exposed to the unobscured radiation. The calculations further show that the lifetimes in clouds of moderate opacity are of the order of one million years. Author

N72-20785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY EMISSION FROM THE GALACTIC DISK
R. D. Bleach, E. A. Boldt, S. S. Holt, D. A. Schwartz, and P. J. Serlemitsos Mar. 1972 15 p refs Submitted for publication
(NASA-TM-X-65857; X-661-72-77) Avail: NTIS CSCL 03B

A search was made of a diffuse component of X-rays > 1.5 keV associated with an interarm region of the galaxy at galactic longitudes in the vicinity of 60 deg. A statistically significant excess associated with a narrow disk component was detected. The angular extent of this component has a most probable value of 2 deg and may be as large as 7 deg at 90% confidence. The best fit spectrum yields an intensity of 2.9 photons 1/(cm2-sec-ster) over the 2 to 10 keV range. The 3 sigma upper limit to any emission (e.g. iron line) in a 1.5 keV band centered at 7 keV from galactic latitudes < h or = 3.5 deg is .3 photons 1/(cm2-sec-ster). Several possible emission models are discussed, with the most likely candidate being a population of unresolvable low luminosity discrete sources. Author

N72-20786*# Translation Consultants, Ltd., Arlington, Va.
PARTICLE ACCELERATION IN SOLAR FLARES
L. I. Miroshnichenko Washington NASA Apr. 1972 11 p Transl. into ENGLISH from Priroda (Moscow), no. 7, Jul. 1971 p 37-41
(Contract NASw-2038)
(NASA-TT-F-14152) Avail: NTIS CSCL 03B

Data are too unreliable to arrive at definite conclusions concerning the processes involved, but it is pointed out that progress was made in reaching an understanding of the mechanisms. Author

N72-20787# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THE RELATIONS BETWEEN CHROMOSPHERIC FEATURES AND PHOTOSPHERIC MAGNETIC FIELDS
E. N. Frazier 15 Mar. 1972 35 p refs
(ATR-72(8102)-5) Avail: NTIS

High resolution photographic magnetograms are compared with H alpha filtergrams (both on - and off - band) for a variety of solar features. It was verified that H alpha filaments overlie neutral lines or bands and that H alpha plages always occur at magnetic field clumps. Author

N72-20788*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RECURRENT NATURE OF TYPE 1 NOISE ACTIVE REGIONS DURING 1965 THROUGH 1969
Kunitomo Sakurai (Maryland Univ.) Mar. 1972 11 p refs
(NASA-TM-X-65865; X-693-72-82) Avail: NTIS CSCL 03B

The recurrent tendency of type I noise sources in metric frequencies is studied during the period from 1965 to 1969. It is shown that their recurrent period is slightly longer than 27.0 days and that the number of such recurrent trends for those noise sources is generally four. Discussion is given on the close relationship between those sources and the active regions where proton flares occur. Author

N72-20789# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
INVESTIGATIONS OF THE MEAN MULTIPLICITY OF VOLATILE NEUTRONS AS A MEASUREMENT FOR CHANGES OF THE ENERGY SPECTRUM OF COSMIC RADIATION [UNTERSUCHUNGEN UEBER DIE MITTLERE MULTIPLIZITAET DER VERDAMPFUNGSNEUTRONEN ALS MASS FUER DUE VERAENDERUNGEN DES ENERGIES-PEKTRUMS DER KOSMISCHEN STRAHLUNG]
Ahmad Zand Niapour 1970 40 p refs In GERMAN; ENGLISH summary
(Rept-44/1970) Avail: NTIS

A neutron monitor has operated on Mount Hafelekar near Innsbruck since June 1968. The recorded pulses of each counting tube are simultaneously conducted into two channels which have different electronic dead times such that one channel records only events and the other the total number of neutrons produced. The ratio of the counting rates in the two channels gives the mean multiplicity as a function of time. The gross variations of the mean multiplicity and of the total intensity measured in each channel are in opposite sense with time; the mean multiplicity decreases by 0.021% with each 1% increase in intensity. Systematic variations in the mean multiplicity seem to show modulation effects which are not observable within the total intensity alone. No systematic changes are observed in connection with the daily variation of the total intensity.
Author (ESRO)

N72-20790# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
THE SOLAR WIND
Carl-Gunne Faelthammar Jun. 1971 32 p refs Revised Submitted for publication
(Rept-70-22-Rev) Avail: NTIS

A survey is presented of solar wind phenomena, interplanetary plasma, and the role of the interplanetary magnetic field. The correlation between solar wind and geomagnetic activity is mentioned. ESRO

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-20791*# California Inst. of Tech., Pasadena. Seismological Lab.
THE LUNAR INTERIOR
Don L. Anderson and Robert L. Kovach 23 Feb. 1972 24 p refs
(Grants NGL-05-002-069; NGL-05-020-232)
(NASA-CR-125813; Contrib-2122) Avail: NTIS CSCL 03B

The compressional velocities are estimated for materials in the lunar interior and compared with lunar seismic results. The lower crust has velocities appropriate for basalts or anorthosites. The high velocities associated with the uppermost mantle imply high densities and a change in composition to a lighter assemblage at depths of the order of 120 km. Calcium and aluminum are probably important components of the upper mantle and are deficient in the lower mantle. Much of the moon may have accreted from material similar in composition to eucrites. The important mineral of the upper mantle is garnet; possible accessory minerals are kyanite, spinel, and rutile. If the seismic results stand up, the high velocity layer in the moon is more likely to be a high pressure form of anorthosite than eclogite, pyroxenite, or dunite. The thickness of the layer is of the order of 50 km. Cosmic abundances can be maintained if the lower mantle is ferromagnesium silicate with minimal amounts of calcium and aluminum. Achondrites such as eucrites and howardites have more of the required characteristics of the lunar interior than carbonaceous chondrites. A density inversion in the moon is a strong possibility. Author

N72-20792*# New Hampshire Univ., Durham. Dept. of Physics
OBSERVATION OF PULSED GAMMA RAYS WITH

ENERGIES GREATER THAN 250 keV FROM THE CRAB NEBULA PULSAR NP 0532 Ph.D. Thesis
Larry E. Orwig Dec. 1971 229 p refs
(Grant NGL-30-002-021)
(NASA-CR-125820; UNH-7203) Avail: NTIS CSCL 03A

Data from a balloon flight experiment using an Na I scintillation spectrometer were analyzed for gamma ray pulsation. The payload was carried to a nominal atmospheric depth of 3.5 g/cm2. A superposed epoch analysis was performed on a 12,000 second portion of the data spanning a total time interval of 16,700 seconds at float altitude. A positive pulsed contribution was observed at the expected apparent frequency of NP 0532 having the typical double pulse structure. The results indicate a time-averaged pulse photon flux of 0.00144 + or - 0.00057 photons/sq cm/sec in the energy interval from 250 keV to 2.3 MeV. This represents a time-averaged pulsed power of 0.000649 + or - 0.000257 keV/sq cm/sec/keV. The ratio of interpulse to main pulse was found to be 2.4 + or - 1.9. The analysis indicates a positive photon flux from 250 keV to 725 keV of 0.00120+ or - 0.00052 photons/sq cm/sec. Author

N72-20793*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
SOUNDING ROCKET FLIGHT REPORT, MUMP 9 AND MUMP 10
H. J. Grassl Nov. 1971 56 p refs
(Contract NAS8-21086; ORA Proj. 089020)
(NASA-CR-122557; Rept-089020-1-F) Avail: NTIS CSCL 16B

The results of the launching of two-Marshall-University of Michigan Probes (MUMP 9 and MUMP 10), Nike-Tomahawk sounding rocket payloads, are summarized. The MUMP is similar to the thermosphere probe, an ejectable instrument package for studying the variability of the earth's atmospheric parameters. The MUMP 9 payload included an omegatron mass analyzer, a molecular fluorescence densitometer, a mini-tilty filter, and a lunar position sensor. This complement of instruments permitted the determination of the molecular nitrogen density and temperature in the altitude range from approximately 143 to 297 km over Wallops Island, Virginia, during January 1971. The MUMP 10 payload included an omegatron mass analyzer, an electron temperature probe, a cryogenic densitometer, and a solar position sensor. These instruments permitted the determination of the molecular nitrogen density and temperature and the charged particle density and temperature in the altitude range from approximately 145 to 290 km over Wallops Island during the afternoon preceding the MUMP 9 launch. Author

N72-20794*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.
HAYSTACK OBSERVATORY Semiannual Report, 1 Jul. - 31 Dec. 1971
15 Jan. 1972 35 p refs
(Contract NAS9-7830; Grants NGR-22-174-003; NSF GP-25865)
(NASA-CR-115454) Avail: NTIS CSCL 03A

Radio astronomy programs comprise three very-long-baseline interferometer projects, ten spectral line investigations, one continuum mapping in the 0.8 cm region, and one monitoring of variable sources. A low-noise mixer was used in mapping observations of 3C273 at 31 GHz and in detecting of a new methyl alcohol line at 36,169 MHz in Sgr B2. The new Mark 2 VLBI recording terminal was used in galactic H2O source observations using Haystack and the Crimean Observatory, USSR. One feature in W29 appears to have a diameter of 0.3 millisec of arc and a brightness temperature of 1.4 x 10 to the 15th power K. Geodetic baseline measurements via VLBI between Green Bank and Haystack are mutually consistent within a few meters. Radar investigations of Mercury, Venus, Mars, and the Moon have continued. The favorable opposition of Mars and improvements in the radar permit measurements on a number of topographic features with unprecedented accuracy, including scarps and crater walls. The floor of Mare Serenitatis slopes upward towards the northeast and is also the location of a strong gravitational anomaly. Author

N72-20795*# General Electric Co., Schenectady, N.Y. General Physics Lab.
INVESTIGATIONS OF LUNAR MATERIALS Final Report
G. M. Comstock, A. O. Fvwaraye, R. L. Fleischer, and H. R. Hart, Jr. 25 Jan. 1972 77 p refs
(Contract NAS9-11583)
(NASA-CR-115470) Avail: NTIS CSCL 03B

The investigations were directed at determining the radiation history and surface chronology of lunar materials using the etched particle track technique. The major lunar materials studied are the igneous rocks and double core from Apollo 12, the breccia and soil samples from Apollo 14, and the core samples from Luna 16. In the course of this work two new and potentially important observations were made: (1) Cosmic ray-induced spallation-recoil tracks were identified. The density of such tracks, when compared with the density of tracks induced by a known flux of accelerator protons, yields the time of exposure of a sample within the top meter or two of moon's surface. (2) Natural, fine scale plastic deformation was found to have fragmented pre-existing charged particle tracks, allowing the dating of the mechanical event causing the deformation. Author

N72-20796*# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
LUNAR SAMPLE ANALYSIS Annual Report, as of 31 Jan. 1972
R. M. Housley 31 Jan. 1972 32 p refs
(Contract NAS9-11539)
(NASA-CR-115465; SC507.3AR) Avail: NTIS CSCL 03B

A simple and convenient method of making quantitative magnetic separations of the lunar fines is described. The fractions obtained form groups containing distinctively different particle types; thus it appears that magnetic separation in itself may be a useful way of characterizing lunar fines. Mossbauer studies of fines 10084 show that the metal can not contain more than about 1.5% Ni implying that by far the bulk of it results from reduction rather than being a direct meteoritic addition. Mossbauer data also places an upper limit on the magnetite content of the fines at least an order of magnitude below that required to account for the characteristic ferromagnetic resonance observed. Microscopic examination of magnetic separates from the 15101 fines suggests that reduction of Fe accompanies every major impact event on the moon and also suggests that the bulk of the material at the collection site has at one time been in an impact plume. Author

N72-20797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE APOLLO 15 X-RAY FLUORESCENCE EXPERIMENT
I. Adler, J. Trombka, J. Gerard, R. Schmadebeck, P. Lowman, H. Blodget, L. Yin, E. Eller, R. Lamothe, P. Gorenstein et al Mar. 1972 43 p refs Submitted for publication
(NASA-TM-X-65834; X-641-72-57) Avail: NTIS CSCL 03A

The CSM spectrometric data on the lunar surface with respect to its chemical composition are presented for Al, Mg, and Si as Al/Si and Mg/Si ratios for the various features overflow by the spacecraft. The lunar surface measurements involved observations of the intensity and characteristic energy distribution of the secondary or fluorescent X-rays produced by the interaction of solar X-rays with the lunar surface. The results showed that the highlands and maria are chemically different, with the highlands having considerably more Al and less Mg than the maria. The mare-highland contact is quite sharp and puts a limit on the amount of horizontal transport of material. The X-ray data suggest that the dominant rock type of the lunar highlands is a plagioclase-rich pyroxene bearing rock, probably anorthositic gabbro or feldspathic basalt. Thus the moon appears to have a widespread differentiated crust (the highlands) systematically richer in Al and lower in Mg than the maria. This crust is pre-mare and may represent the first major internal differentiation of the moon. Author

N72-20798# Illinois Univ., Urbana. Aeronomy Lab.
THE LUNAR SEMIDIURNAL VARIATION IN OI(5577 ANGSTROM) NIGHTGLOW
J. M. Forbes and M. A. Geller [1971] 17 p refs
(Contract NSF GA-25660)
Avail: NTIS

The effect of lunar tidal dynamics on the OI (5577 A) airglow is studied for the Chapman reaction, Barth's mechanism, and the F-region contribution to the green-line intensity. The computed E-region variations are of the same order as the observed lunar variations in the airglow and agree well in phase. The F-region contribution is found to be of roughly the same order as the lunar variation that is calculated for the E region, but possibly with much different phase. It is concluded that the dynamics of the lunar tide are sufficient to produce a lunar variation in green-line airflow similar to that which is observed.
Author

N72-20799*# National Aeronautics and Space Administration, Washington, D.C.
THE PLANET MERCURY (1971) NASA Space Vehicle Design Criteria (Environment)
Mar. 1972 63 p refs
(NASA-SP-8085) Avail: NTIS CSCL 03B

The physical properties of the planet Mercury, its surface, and atmosphere are presented for space vehicle design criteria. The mass, dimensions, mean density, and orbital and rotational motions are described. The gravity field, magnetic field, electromagnetic radiation, and charged particles in the planet's orbit are discussed. Atmospheric pressure, temperature, and composition data are given along with the surface composition, soil mechanical properties, and topography, and the surface electromagnetic and temperature properties.
N.E.N.

N72-20800*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE MARINER MARS 1971 MISSION. PRELAUNCH PHASE THROUGH FIRST TRAJECTORY CORRECTION MANEUVER, VOLUME 1
R. P. Laeser, G. P. Textor, L. B. Kelly, and M. Kelly 15 Mar. 1972 270 p
(Contract NAS7-100)
(NASA-CR-125885; JPL-TM-33-523-Vol-1) Avail: NTIS CSCL 22C

The DSN command system provided the capability to enter commands in a computer at the deep space stations for transmission to the spacecraft. The high-rate telemetry system operated at 16,200 bits/sec. This system will permit return to DSS 14 of full-resolution television pictures from the spacecraft tape recorder, plus the other science experiment data, during the two playback periods of each Goldstone pass planned for each corresponding orbit. Other features included 4800 bits/sec modem high-speed data lines from all deep space stations to Space Flight Operations Facility (SFOF) and the Goddard Space Flight Center, as well as 50,000 bits/sec wideband data lines from DSS 14 to the SFOF, thus providing the capability for data flow of two 16,200 bits/sec high-rate telemetry data streams in real time. The TDS performed prelaunch training and testing and provided support for the Mariner Mars 1971/Mission Operations System training and testing. The facilities of the ETR, DSS 71, and stations of the MSFN provided flight support coverage at launch and during the near-earth phase. The DSSs 12, 14, 41, and 51 of the DSN provided the deep space phase support from 30 May 1971 through 4 June 1971.
Author

N72-20801# Astronomisches Inst., Bonn (West Germany).
ABSOLUTE PROPER MOTIONS OF OPEN STAR CLUSTERS [DIE ARSOLUTE EIGENBEWEGUNG OFFENER STERNHAUFEN.]
Heinrich VanSchewick 1971 37 p refs In GERMAN
(Publ-84) Avail: NTIS

Absolute proper motions in the FK4 system have been obtained for 61 open star clusters. Measurements and re-reduced data were used separately and in combination. A discussion is given for every cluster. The velocity of the sun relative to open clusters turns to be smaller than the standard solar motion and nearly equals the basic solar motion. The solar apex for open clusters is similar to that obtained for objects with small space velocities and OB stars from their proper motions and radial velocities.
Author

N72-20802# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
THE CAPTURE AND ESCAPE BEHAVIOUR OF SUN/PLANET SYSTEMS
O. Bschorr and A. Leibold Jul. 1971 55 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-78) Avail: NTIS; DFVLR Porz-Wahn: 16,10 DM

The capture and escape behavior of the planets during a flyby was determined. The Sun/Jupiter system was found to be able to capture interstellar material moving with a velocity of less than 31.5 km/sec. The corresponding capture velocity for the Earth was calculated to be 16.5 km/sec. The parameters of those interplanetary trajectories were calculated from which a body can escape into the interstellar space after a flyby process. As far as this escape behavior is concerned the outer planets are very effective. Using a Monte Carlo model the probability for capturing and escaping was estimated in order to simulate the gain and loss of mass of the Sun/Earth system. This method allows to estimate the ratio of the number of captured as well as escaped bodies to the number of meteor falls on Earth.
Author

N72-20803*# National Aeronautics and Space Administration, Washington, D.C.
NEWS CONFERENCE ON MARINER 9: NEWS RELEASE
2 Feb. 1972 131 p
(NASA-TM-x-67671) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22C

A discussion is presented on Mariner 9 data on Mars. The atmosphere and dust are described, and details are given on the surface features of the planet. Ultraviolet and infrared data are also discussed, as is the question on Martian life. Photographs showing clouds and surface are included.
N.E.N.

N72-20804# Joint Publications Research Service, Arlington, Va.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 272
14 Mar. 1972 86 p Transl. into ENGLISH from Russian reports
(JPRS-55426) Avail: NTIS

Materials from recent publications of the Sino-Soviet bloc countries are presented in the form of abstracts, summaries, and occasionally full articles. The topics covered are astronomy, meteorology, oceanography, geology, upper atmosphere, and space research.
Author

N72-20805*# TRW Systems Group, Redondo Beach, Calif.
COSMIC DUST ANALYZER Patent Application
Neal Roy, inventor (to NASA) Filed 14 Oct. 1971 41 p
(Contract NAS9-9309)
(NASA-Case-MSC-13802-1; US-Patent-Appl-SN-189438) Avail: NTIS CSCL 03B

The cosmic dust analyzer utilizes the ionization produced by the impact of a hypervelocity particle upon a solid target and employs ion time-of-flight techniques to separate the microplasm formed by impact into its constituent parts. The characteristic shape of the collector signal provides an unambiguous signal of an impacting particle, thereby eliminating spurious signals.
NASA

N72-20806*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF THE MARINER 6 AND 7 MARS OCCULTATION EXPERIMENTS
Joseph S. Hogan, Richard W. Stewart, S. I. Rasool, and L. H. Russell Washington Mar. 1972 40 p refs
(NASA-TN-D-6683; G-1050) Avail: NTIS CSCL 22C

Final profiles of temperature, pressure, and electron density on Mars were obtained for the Mariner 6 and 7 entry and exit cases, and results are presented for both the lower atmosphere and ionosphere. The results of an analysis of the systematic and formal errors introduced at each stage of the data-reduction process are also included. At all four occulation points, the lapse rate of temperature was subdadiabatic up to altitudes in excess of 20 km. A pronounced temperature inversion was present above the surface at the Mariner 6 exit point. All four profiles exhibit a sharp, superadiabatic drop in temperature at high altitudes, with temperatures falling below the frost point of CO2. These results give a strong indication of frozen CO2 in the middle atmosphere of Mars. Author

N72-20807# Astronomisches Inst., Bonn (West Germany).
SIX PHOTOELECTRIC STANDARD SEQUENCES IN THE SOUTHERN MILKY WAY. PHOTOELECTRIC OBSERVATIONS OF STARS IN THE SOUTHERN OPEN CLUSTERS NGC 2335, NGC 2343, NGC 2453, NGO 4439 AND H 5
Wilhelm Seggewiss 1971 35 p refs
(Rept-82; Rept-83) Avail: NTIS

The UBV magnitudes and colors of stars in six standard sequences near galactic longitudes 212, 223, 243, 265, 279, and 300 deg are presented. The number of stars in each sequence is 21 to 24, and the limiting V magnitudes are 14.m8 to 15.m6. Identification charts, two color diagrams and estimates of spectral types derived from these diagrams are given. Photoelectric UBV measurements were also obtained for small numbers of stars in the southern open clusters. In these cases the data are sufficient for the determination of distances and color excesses of the clusters from the two-color and color magnitude diagrams. The measurements were obtained in connection with the observations of six standard sequences in the Southern Milky Way. All observations were carried out in February and March 1969 with the photoelectric equipment of the ESO Im-telescope at La Silla, Chile. Author

N72-20808# Sternwarte Pulsnitz (West Germany).
TELESCOPIC OBSERVATIONS OF COMETS [DIE TELESKOPISCHE BEBACHTUNG DER KOMETEN]
J. Classen 1970 10 p refs In GERMAN; ENGLISH summary
(Publ-7) Avail: NTIS

The application of telescopes for the observation of comets is discussed. Examples are given to illustrate conditions under which telescopic observations of comets are superior to photographic recording. A chronology of comets discovered by telescopic viewing is presented. The system by which newly discovered comets are reported by the discoverer is explained. Author

N72-20809*# National Aeronautics and Space Administration, Washington, D.C.
MARINER-VENUS 1967 Final Project Report
1971 310 p refs
(NASA-SP-190) Avail: NTIS; SOD $3.00 as 3300-0393 CSCL 22C

Detailed information on the spacecraft performance, mission operations, and tracking and data acquisition is presented for the Mariner Venus 1967 and Mariner Venus 1967 extension projects. Scientific and engineering results and conclusions are discussed, and include the scientific mission, encounter with Venus, observations near Earth, and cruise phase of the mission. Flight path analysis, spacecraft subsystems, and mission-related hardware and computer program development are covered. The scientific experiments carried by Mariner 5 were ultraviolet photometer, solar plasma probe, helium magnetometer, trapped radiation detector, S-band radio occultation, dual-frequency radio propagation, and celestial mechanics. The engineering experience gained by converting a space Mariner Mars 1964 spacecraft into one flown to Venus is also described. N.E.N.

N72-20810*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RECOVERY CONSIDERATIONS FOR POSSIBLE HIGH INCLINATION LONG DURATION EARTH ORBITAL MISSIONS
Thomas E. OBriant and Jonny E. Ferguson 2 Oct. 1969 44 p refs
(NASA-TM-X-67667; MSC-00158) Avail: NTIS CSCL 22C

Problem areas are discussed and various solutions proposed. One of the major recovery problems encountered with missions having higher orbital inclinations than previous missions is the greater likelihood of severe weather conditions in the landing zones, especially if landing zones are optimized for orbital coverage considerations. Restricting the reentry window and increasing in-orbit wait times can partially eliminate the weather problem, but the possibility of emergency landings at higher latitudes still exists. It can be expected that the increased confidence level in spacecraft reliability that will exist by the time the high-inclination missions are flown will reduce the probabilities of an emergency landing in an unfavorable recovery location to a very low level. Author

N72-20811# Consiglio Nazionale delle Ricerche, Frascati (Italy). Lab. di Astrofisica.
A POSSIBLE MECHANISM FOR THE CAPTURE OF MICROPARTICLES BY THE EARTH AND PLANETS OF THE SOLAR SYSTEM
F. DiBenedetto Oct. 1971 15 p ref Presented at the IAU Colloq. on Phys. of Meteors, Albany, 14-18 Jun. 1971
(N-71/27) Avail: NTIS

A planet may intercept a swarm of meteoroid particles from any direction. By applying Lyttleton's theory for the formation of comets, a mechanism for the origin and formation of a concentration zone of cosmic particles around the Earth and other planets of the solar system is postulated. It is found that there is no possibility of accretion for Mercury, Mars, and the Moon, while the radii of capture of microparticles in solid form varies from a minimum of 2.95 planetary radii for Venus, 3.47 for the Earth, to about 986 for Jupiter. ESRO

N72-20812*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MICROCRATERS FORMED IN GLASS BY LOW DENSITY PROJECTILES
J. C. Mandeville (ONERA, Toulouse) and James F. Vedder Toulouse ONERA Oct. 1971 30 p refs Sponsored in part by ESRO
(NASA-TM-X-68301; ONERA-NT-01-13-71) Avail: NTIS CSCL 03B

Microcraters were produced in soda-lime glass by the impact of low density projectiles of polystyrene with masses between 0.7 and 62 picograms and velocities between 2 and 14 kilometers per second. The morphology of the craters depends on the velocity and angle of incidence of the projectiles. The transitions in morphology of the craters formed by polystyrene spheres occur at higher velocities than they do for more dense projectiles. For oblique impact, the craters are elongated and shallow with the spallation threshold occuring at higher velocity. For normal incidence, the total displaced mass of the target material per unit of projectile kinetic energy increases slowly with the energy. Author (ESRO)

N72-20813# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugmechanik der Luftfahrzeuge.
COMPARISON OF DIFFERENT METHODS FOR THE DETERMINATION AND PREDICTION OF SATELLITE

ORBITS
Knut Wilhelm 1971 54 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-76) Avail: NTIS; DFVLR, Porz: 13,50 DM

The results of an investigation on the efficiency of satellite orbit prediction programs are given. The computing methods of Brouwer, Claus and Lubowe, Izsak, and Aeronutronic were programmed and studied. For the evaluation of the methods, systematic comparative calculations were carried out using the results of direct numerical intergration of the equations of motion. The accuracy of the methods was determined by comparing the components of the position and velocity vector and the elements. The method OPIMS by Claus and Lubowe was found to yield the most accurate results over a broad spectrum of inclination and eccentricity. Author (ESRO)

N72-20883*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTIMAL LIFTING ASCENT TRAJECTORIES FOR THE SPACE SHUTTLE
Timothy R. Rau and Jarrell R. Elliott *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1063-1087 refs (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

N72-20884*# North American Rockwell Corp., Downey, Calif. Space Div.
OPTIMAL ASCENT TRAJECTORIES OF A TWO STAGE SPACE SHUTTLE VEHICLE
R. A. Wilson *In* NASA. Langley Res. Center Space Shuttle Aerothemodyn. Tech. Conf., vol. 4 Feb. 1972 p 1089-1108 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

N72-20885*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ABORT SEPARATION OF THE SHUTTLE
John P. Decker, Kenneth L. Blackwell, Joseph L. Sims, R. H. Burt (ARO), W. T. Strike, Jr. (ARO), C. Donald Andrews (Lockheed Missiles and Space Co., Huntsville, Ala.), L. Ray Baker, Jr. (Lockheed Missiles and Space Co., Huntsville, Ala.), and John M. Rampy (Northrop Corp., Huntsville, Ala.) *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1105-1164 refs (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

N72-20886*# General Dynamics/Convair, San Diego, Calif.
BOOSTER RECOVERY FOLLOWING PREMATURE SPACE SHUTTLE STAGE SEPARATION
M. J. Hurley *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1165-1189 refs (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

N72-20889*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ORBITER ENTRY TRAJECTORY CONSIDERATIONS
John J. Rehder and Paul F. Holloway *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1265-1300 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

N72-20890*# General Dynamics/Convair, San Diego, Calif.
STAGE SEPARATION OF PARALLEL-STAGED SHUTTLE VEHICLES, A CAPABILITY ASSESSMENT
M. J. Hurley and G. W. Carrie *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1301-1395 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

N72-20891*# General Dynamics/Fort Worth, Tex. Aerospace Div.
SPACE SHUTTLE BOOSTER FLYBACK SYSTEM SYNTHESIS
D. W. Jones, W. J. Moran, and V. A. Lee *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1397-1437 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

N72-20892*# General Dynamics/Convair, San Diego, Calif.
OPTIMIZED SPACE SHUTTLE TRAJECTORY SIMULATION
Louis Tramonti and Richard G. Brusch *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1439-1473 refs (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-20814*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PROPOSED PRELIMINARY CRITERIA FOR SPACE SHUTTLE ACCESS EQUIPMENT AT THE OPERATIONAL SITE
Preston E. Beck, 15 Jun. 1971 26 p
(NASA-TM-X-67651; KSC-TR-1118) Avail: NTIS CSCL 22B

A comparison was made between the methods of access utilized, or proposed, by the military, commercial airlines, and the space shuttle Phase B contractors. The methodology was subjected to consideration for space shuttle use and similarity to current space shuttle access concepts. The Phase B contractor concepts were in turn examined for degree of use of the state-of-the-art and progressive extension of new cost-effective ideas. This comparison disclosed a need for better definition of the criteria/requirements for space shuttle access equipment. Preliminary criteria, needed prior to initiation of the detail design (Phase C/D effort) of ground hardware for the operational site, are presented. Author

N72-20815*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MODULAR SPACE STATION Technical Summary
Feb. 1972 289 p
(Contract NAS8-25140)
(NASA-CR-123546; MDC-G2708) Avail: NTIS CSCL 22B

The modular space station comprising small, shuttle-launched modules, and characterized by low initial cost and incremental manning, is described. The initial space station is designed to be delivered into orbit by three space shuttles and assembled in space. The three sections are the power/subsystems module, the crew/operations module, and the general purpose laboratory module. It provides for a crew of six. Subsequently duplicate/crew/operations and power/subsystems modules will be mated to the original modules, and provide for an additional six crewmen. A total of 17 research and applications modules is planned, three of which will be free-flying modules. Details are given on the program plan, modular characteristics, logistics, experiment support capability and requirements, operations analysis, design support analyses, and shuttle interfaces. N.E.N.

N72-20816*# Radio Corp. of America, Van Nuys, Calif. Electromagnetic and Aviation Systems Div.
DISCRETE INPUT EQUIPMENT DESIGN STUDY Final Report

Jan. 1972 52 p
(Contract NAS8-27801)
(NASA-CR-123583) Avail: NTIS CSCL 22B

The study to improve the reliability of the LUT system by discrete input equipment (DIE) is reported. Subjects discussed include: specifications, packaging, aircraft integrated systems, and word formats DIE. It is recommended that maximal use of advanced technology be made, particularly the 'know how' developed on the Saturn project. F.O.S.

N72-20817*# Santa Clara Univ., Calif.
BOUNDEDNESS REGIONS OF DISCRETE-TIME DYNAMIC SYSTEMS Final Report, 30 Jun. - 15 Dec. 1972
Dragoslav Siljak, George J. Thaler, and Stein Weissenberger
1 Mar. 1972 80 p refs
(Contract NAS8-27799)
(NASA-CR-123594) Avail: NTIS CSCL 12A

Techniques for obtaining quantitative information about boundedness properties are developed and applied to the sampled-data control of satellite attitude with quantization. Relevant stability concepts are introduced as a series of definitions, and interrelationships between various definitions are discussed. The boundedness regions are estimated by means of quadratic Liapunov functions, and a sufficient condition for the existence of a boundedness region is given for a certain class of systems. A quadratic Liapunov function is applied to the Lur'e-Postinkov class of systems, where the linear part of the system is not asymptotically stable and the quantizer represents the nonlinear characteristic. A numerical calculation of the region of boundedness estimates is performed for satellite attitude control and is compared with simulation results. It is tentatively concluded that the Liapunov results may be good and that simulation results may be difficult to interpret and time-consuming to generate. The Lur'e-based technique yields estimates of regions of absolute boundedness, but at the cost of greater analytical complexity. N.E.N.

N72-20818*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Progress Report, 1 Jul. - 31 Dec. 1971
D. K. Frederick, P. K. Lashmet, G. N. Sandor, C. N. Shen, E. J. Smith, and S. W. Yerazunis 31 Dec. 1971 94 p refs
(Grant NGL-33-018-091)
(NASA-CR-125919; RPI-TR-MP-25) Avail: NTIS CSCL 22B

Investigation of problems related to control of a mobile planetary vehicle according to a systematic plan for the exploration of Mars has been undertaken. Problem areas receiving attention include: (1) overall systems analysis; (2) vehicle configuration and dynamics; (3) toroidal wheel design and evaluation; (4) on-board navigation systems; (5) satellite-vehicle navigation systems; (6) obstacle detection systems; (7) terrain sensing, interpretation and modeling; (8) computer simulation of terrain sensor-path selection systems; and (9) chromatographic systems design concept studies. The specific tasks which have been undertaken are defined and the progress which has been achieved during the period July 1, 1971 to December 31, 1971 is summarized. Author

N72-20819*# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
APPLICATION OF NUMERICAL METHODS TO EXTEND CAPABILITIES FOR OPTIMAL ROCKET GUIDANCE: REPORT ON REENTRY GUIDANCE OF SHUTTLE ORBITER Final Report
8 Mar. 1972 53 p refs
(Contract NAS8-21315)
(NASA-CR-123578) Avail: NTIS CSCL 22B

Analytical models are presented for optimal trajectories and reentry guidance of the space shuttle orbiter. Major emphasis is placed on the development of a 'footprint', which refers to a set of reachable destination positions attainable by the shuttle at a specified terminal altitude. An unconstrained reentry footprint was calculated for a shuttle vehicle which enters the earth's atmosphere at 93 km initial altitude after a deboost from a near earth orbit. The method of computation is briefly described, and graphs are presented which illustrate the footprint and the variation of state and control variables along it. The effects of constraints and of variations in initial state upon the footprint are discussed. D.L.G.

N72-20820*# Unidev, Inc., Huntsville, Ala.
COMPUTER SIMULATION OF SATURN 5 RESPONSE TO PRE-LAUNCH WIND LOADS
T. Coffin Nov. 1970 73 p refs
(Contract NAS8-21418)
(NASA-CR-102977; UR-00012) Avail: NTIS CSCL 22D

A digital computer program is described which was developed to estimate Saturn 5 response to prelaunch wind conditions at Cape Kennedy. The program computes displacement and bending moment statistics as a function of parameters defining the atmospheric environment. A sample problem is provided to illustrate utilization of the program. Author

N72-20821*# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE SHUTTLE ALTERNATE AVIONICS SYSTEM STUDY AND PHASE B EXTENSION Final Report
12 Nov. 1971 471 p refs
(Contract NAS9-10960)
(NASA-CR-115447; SD-71-346; MSC-03329) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

An alternate concept for the space shuttle avionics system to reduce cost and complexity is presented. Minimizing total development costs and spreading them as a function of time were the primary objectives. The approaches use conventional concepts, require minimum development and verification, and take full advantage of past experience on other programs. The level of redundancy required and the lower degree of automation are discussed. A comprehensive summary is provided of all configurations previously defined and comparison is made with the alternate concept. Author

N72-20822*# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE SHUTTLE PHASE B EXTENSION TECHNICAL REPORT, VOLUME 1
12 Nov. 1971 145 p
(Contract NAS9-10960)
(NASA-CR-115448; SD-71-342-Vol-1; MSC-03328-Vol-1) Avail: NTIS CSCL 22B

Study extension activities performed to investigate modifications to the reusable space shuttle concept are summarized. The investigation of various space shuttle system options were performed in two phases. Phase 1 encompassed investigation of systems using orbiters with external propellant tanks and an interim expendable booster, which allowed phased development of the reusable orbiter and booster. Phase 2 studies were directed toward the definition of a program which would maximize the use of existing technology for the orbiter and which would also use existing hardware for the booster, as well as the simplification of designs for cost reduction. Author

N72-20823*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC CHARACTERISTICS OF 0.003367 SCALE MODELS OF THE MMC RETRO-GLIDE BOOSTER ALONE AND MATED WITH THE MSC 040-A ORBITER
D. J. Michna and D. Allayaud Feb. 1972 370 p
(Contract NAS8-4016)
(NASA-CR-120031; DMS-DR-1213) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Plotted data results are presented of aerodynamic tests

conducted on the 0.003367 scale models of the retro-glide booster alone and mated with the 040A orbiter. The test was conducted in the NASA/MSFC 14 Inch Trisonic Wind Tunnel over a Mach number range of 0.6 to 4.95 with angles of attack varying from -10 deg to 60 deg. The test was to obtain six degree of freedom force and moment data on the launch configuration and booster reentry configuration for preliminary stability and control analysis. Author

N72-20824*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: AERODYNAMIC CHARACTERISTICS OF A COMPOSITE BOOSTER/040A ORBITER LAUNCH CONFIGURATION WITH FIN AND BOOSTER BODY CONFIGURATION EFFECT CONTRIBUTION
R. W. Ainsworth, J. C. Johnson, and L. L. Watts Feb. 1972 87 p
(Contract NAS8-4016)
(NASA-CR-120039; DMS-DR-1227) Avail: NTIS CSCL 22B

An investigation was made of the fin configuration and booster body configuration effects on a composite booster/040A orbiter launch configuration. Aerodynamic performance and stability characteristics in pitch and yaw were obtained. Configurations tested included two stepped cylindrical bodies of different lengths with a conical nose, four fin shapes of various sizes and aspect ratios mounted in different positions around the base of the bodies, two base flare angles and three 040A orbiter configurations. The orbiter variations included a tailless configuration and two tail sizes. A tailless booster launch configuration with deflected petals (expanded flare sectors) was also tested. The model scale was 0.003366. Data were converted to coefficient form in near real time, punched on cards, and tabulated. The cards used in conjunction with a Benson-Lehner plotter were used to provide plotted data. At the end of the test, tabulated input forms were completed for the SADSAC computer program to aid in publishing the final test data report. Author

N72-20825*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
SHUTTLE/AGENA STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
25 Feb. 1972 48 p
(Contract NAS9-11949)
(NASA-CR-115491; LMSC-D152635-Vol-1) Avail: NTIS CSCL 22B

A study to identify and define this significant space shuttle/Agena space tug interfaces is presented. The preliminary design for an Agena space tug including optional improved features is discussed. Performance capability was determined on the basis of Agena mass properties corresponding to the requirements for each of the three base line missions. A work breakdown structure in sufficient detail to assemble a complete set of cost data was developed. Author

N72-20826*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
SHUTTLE/AGENA STUDY. VOLUME 2, PART 1: PROGRAM REQUIREMENTS, CONCLUSIONS, RECOMMENDATIONS Final Report
25 Feb. 1972 111 p
(Contract NAS9-11949)
(NASA-CR-115489; LMSC-D152635-Vol-2-Pt-1) Avail: NTIS CSCL 22B

An evaluation to determine the compatibility of the Agena with the space transportation system for use as an expendable third stage to the space shuttle was conducted. The Agena was considered for those missions requiring additional propulsion capability beyond that used for low earth orbit. The study defines the interface requirements imposed on both the Agena and the shuttle system and identifies those areas where the Agena must be improved or modified to satisfy mission requirements. Author

N72-20827*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
SHUTTLE/AGENA STUDY. VOLUME 2, PART 2: AGENA TUG CONFIGURATIONS, SHUTTLE/AGENA INTERFACE, PERFORMANCE, SAFETY, COST Final Report
25 Feb. 1972 303 p
(Contract NAS9-11949)
(NASA-CR-115488; LMSC-D152635-Vol-2-Pt-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

An evaluation of the compatibility of the space shuttle and Agena rocket vehicle was conducted. The Agena space tug configuration design is described in terms of the total vehicle system as well as the individual subsystems and major assemblies and components. The complete interface between the Agena space tug and the space shuttle orbiter is defined for in-flight and ground operations. The derivation and design of an evolutionary stage is also presented. This vehicle conforms to the same guidelines and interface requirements as the Agena space tug. Performance data developed for both vehicles for each of the three study baseline missions are included. Author

N72-20828*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
SHUTTLE/AGENA STUDY. VOLUME 2, PART 3: PRELIMINARY TEST PLANS Final Report
25 Feb. 1972 213 p
(Contract NAS9-11949)
(NASA-CR-115490; LMSC-D152635-Vol-2-Pt-3) Avail: NTIS CSCL 22B

Proposed testing for the Agena tug program is based upon best estimates of shuttle and Agena tug requirements and upon the Agena configuration currently envisioned to meet these requirements. The proposed tests are presented in development, qualification, system, and launch base test plans. These plans are based upon generalized requirements and assumed situations. The limitations of this study precluded all but minimal consideration of related shuttle orbiter and shuttle ground systems. The test plans include provisions for all testing from major component to systems level, identified as necessary to aid in confirmation of the modified Agena configuration for the space tug; considerations that crew safety requirements and new environmental conditions from shuttle interface effects do impose some new Agena testing requirements; considerations that many existing Agena flight-qualified components will be utilized and qualification testing will be minimal; testing not only for the Agena tug but also for new or modified items of handling or servicing equipment for supporting the Agena factory-to-launch sequence; and the assembly of required testing into a sequence-ordered series of events. Author

N72-20829*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
SHUTTLE/AGENA STUDY. ANNEX A: ASCENT AGENA CONFIGURATION Final Report
15 Feb. 1972 184 p
(Contract NAS9-11949)
(NASA-CR-115485; LMSC-D152635-Ser-1-Annex-A) Avail: NTIS CSCL 22B

Details are presented on the Agena rocket vehicle description, vehicle interfaces, environmental constraints and test requirements, software programs, and ground support equipment. The basic design concept for the Ascent Agena is identified as optimization of reliability, flexibility, performance capabilities, and economy through the use of tested and flight-proven hardware. The development history of the Agenas A, B, and D is outlined and space applications are described. N.E.N.

N72-20830*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
SHUTTLE/AGENA STUDY. ANNEX B: CATALOG OF EXISTING FLIGHT EQUIPMENT Final Report
25 Feb. 1972 342 p
(Contract NAS9-11949)

(NASA-CR-115486; LMSC-D152635-Ser-1-Annex-B) Avail: NTIS CSCL 22B

The Agena space tug design was based on the requirements of representative reference missions, the use of existing hardware, and the experience gained from more than 300 Agena flights. To provide a convenient reference for understanding the Agena tug design selection or for evaluating alternative concepts, this catalog of existing flight equipment was prepared. Equipment descriptions are grouped by Agena subsystem, as follows: spaceframe; propulsion; electrical; guidance and flight controls; and telemetry, tracking, and command. These systems, most of which have been flight qualified on prior Agena programs, permit specialized mission requirements to be satisfied without sacrificing cost or reliability. Author

N72-20831*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.

SHUTTLE/AGENA STUDY. ANNEX C: SPACE SHUTTLE CANDIDATE INSULATOR/PROPELLANT Final Report

25 Feb. 1972 15 p

(Contract NAS9-11949)

(NASA-CR-115487; LMSC-D152635-Ser-1-Annex-C) Avail: NTIS CSCL 22B

The problem associated with the absorption of space tug propellants by the thermal insulation of the space shuttle orbiter during an emergency propellant dump was investigated. A test program was conducted to determine the compatibility of two space shuttle candidate insulation samples with earth-storable propellants. The propellant combinations used were placed in contact with the thermal insulation for two hours. Following exposure to propellants, the insulation samples were heated to 850 F for five minutes. A thermal conductivity index was determined before and after testing to evaluate possible degradation of sample chemical conductivity. Author

N72-20832*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

REFURBISHMENT COST STUDY OF THE THERMAL PROTECTION SYSTEM OF A SPACE SHUTTLE VEHICLE, PHASE 2 Final Report

D. W. Haas 1 Apr. 1972 333 p refs

(Contract NAS1-10990)

(NASA-CR-112034) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The labor costs and techniques associated with the refurbishment and maintenance of representative thermal protection system (TPS) components and their attachment concepts suitable for space shuttle application are defined, characterized, and evaluated from the results of an experimental test program. This program consisted of designing selected TPS concepts, fabricating and assembling test hardware, and performing a time and motion study of specific maintenance functions of the test hardware on a full-scale- mockup. Labor requirements and refurbishment techniques, as they relate to the maintenance functions of inspection, repair, removal, and replacement were identified. Author

N72-20833*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

MODULAR SPACE STATION MASS PROPERTIES Final Report

3 Apr. 1972 185 p

(Contract NAS8-25140)

(NASA-CR-123542; MDC-G2599; MSFC-DPD-235) Avail: NTIS CSCL 22B

An update of the space station mass properties is presented. Included are the final status update of the Initial Space Station (ISS) modules and logistic module plus incorporation of the Growth Space Station (GSS) module additions. Author

N72-20834*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON OBTAINING LUNAR MISSION LAUNCH OPPORTUNITIES RAE-B Mission Analysis Report

Hobart Swartwood, Jr. Feb. 1972 36 p refs Submitted for publication

(NASA-TM-X-65856; X-551-72-69; Rept-2) Avail: NTIS CSCL 22A

A general procedure for predicting launch opportunities for the RAE-B lunar orbiter mission is presented. It is shown that knowledge of the earth-moon distance and lunar phase and declination are sufficient to determine launch periods consistent with present mission constraints and to approximately predict launch, transfer, and arrival parameters such as park orbit coast time, the possiblity of shadows in all phases of the mission, arrival energy, and the amount of sunlit orbit time in the lunar orbit. Constraints on RAE-B include bounds on the spin axis-sun angle in the translunar trajectory, an upper limit on the arrival energy, and a minimum time for sunlight duration in lunar orbits are being considered for the mission. Comparisons are made of relevant parameters for the two cases. The general features of launch, transfer, and arrival parameters are discussed and are shown to be a function of lunar declination, flight time, and launch azimuth. Author

N72-20835*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ISIS-B SPACECRAFT MAGNETIC TESTS

J. C. Boyle Feb. 1972 22 p refs

(NASA-TM-X-65858; X-325-72-81) Avail: NTIS CSCL 22B

Magnetic tests of the ISIS B spacecraft were conducted to determine the various magnetic moments of the spacecraft, evalute its spin and attitude control systems, and calibrate the six onboard magnetometer probes. Test procedures and equipment are described. Techniques for evaluting the data are discussed, and test results are presented. The spacecraft's magnetic characteristics were found to be satisfactory. Proper threshold values for gating the torquing coils were obtained. The onboard magnetometers were satisfactorily calibrated. Author

N72-20836*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SAS-A SPACECRAFT MAGNETIC TESTS

J. C. Boyle Dec. 1970 43 p refs

(NASA-TM-X-65861; X-325-72-38) Avail: NTIS CSCL 22B

Magnetic tests were conducted on the spacecraft for: (1) alignment, compensation, calibration, and bias determination for the spacecraft three-axis vector magnetometer; (2) determination of permanent, induced, and stray magnetic moments of the spacecraft and compensation of permanent magnetic moments by permanent magnets; and (3) evaluation of the spin and attitude control system. Author

N72-20837*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

DYNAMIC CHARACTERISTICS OF A VARIABLE-MASS FLEXIBLE MISSILE: DYNAMICS OF A TWO-STAGE VARIABLE-MASS FLEXIBLE ROCKET Semiannual Technical Progress Report, 1 Mar. - 31 Aug. 1969

Leonard Meirovitch and John Bankovskis Aug. 1969 54 p refs

(Grant NGR-36-004-030)

(NASA-CR-112043; SATPR-4) Avail: NTIS CSCL 16D

The dynamic characteristics of two-stage slender elastic body were investigated. The first stage, containing a solid-fuel rocket, possesses variable mass while the second stage, envisioned as a flexible case, contains packaged instruments of constant mass. The mathematical formulation was in terms of vector equations of motion transformed by a variational principle into sets of scalar differential equations in terms of generalized coordinates. Solutions to the complete equations were obtained numerically by means of finite difference techniques. The problem has been programmed in the FORTRAN 4 language and solved on an IBM 360/50 computer. Results for limited cases are presented showing the nature of the solutions. Author

N72-20838*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
DYNAMIC CHARACTERISTICS OF A VARIABLE-MASS FLEXIBLE MISSILE Semiannual Technical Progress Report, 1 Jul. - 31 Dec. 1970
Leonard Meirovitch and John Bankovskis Dec. 1970 71 p refs (Grant NGR-36-004-030)
(NASA-CR-112044; SATPR-6) Avail: NTIS CSCL 16D

The general motion of a variable mass flexible missile with internal flow and aerodynamic forces is considered. The resulting formulation comprises six ordinary differential equations for rigid body motion and three partial differential equations for elastic motion. The simultaneous differential equations are nonlinear and possess time-dependent coefficients. The differential equations are solved by a semi-analytical method leading to a set of purely ordinary differential equations which are then solved numerically. A computer program was developed for the numerical solution and results are presented for a given set of initial conditions. Author

N72-20839# TRW Systems Group, Redondo Beach, Calif.
ATMOSPHERIC DRAG CROSS-SECTION OF SPACECRAFT SOLAR ARRAYS
Richard R. Williams 29 Mar. 1971 31 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Spacecraft and Rockets in Jul. 1972
Avail: NTIS

Analytic approximations are derived for the average drag cross section of large planar spacecraft solar arrays oriented toward the sun. The effective array cross section is first averaged over a single orbit revolution, and the dependence on orbit inclination and node, as well as on solar position, is shown. Then this short-term result is averaged over complete cycles of nodal regression and solar declination, thus yielding long-term averages of solar array drag cross section. Numerical evaluation of these results, for both high and low orbit inclinations, differs considerably from the answer given by the random tumbling approximation. Author

N72-20840*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN AIRLOCK Patent Application
Hal R. Linderfelt, inventor (to NASA) Filed 24 Jan. 1972 48 p (NASA-Case-MFS-20922; US-Patent-Appl-SN-220274) Avail: NTIS CSCL 22B

An airlock is described for use in transferring waste objects from a positively pressurized enclosure aboard an operative space vehicle, to a waste receiver attached to the vehicle and maintained at the negative pressure of a celestial space environment. The airlock is characterized by a shell having an internal chamber and hermetically sealed within an opening formed in a bulkhead of the enclosure. The shell is provided with an insertion hatch adjacent to the enclosure, and an ejection hatch adjacent the waste receiver, each hatch being hermetically sealed by a hatch cover. A three-way selector valve is provided for alternately coupling the chamber with the enclosure and the receiver in response to manipulation of the mechanism. NASA

N72-20841*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: MISSION PLANNING FOR APOLLO ENTRY
Claude A. Graves and Jon C. Harpold Washington Mar. 1972 27 p refs
(NASA-TN-D-6725; MSC-S-305) Avail: NTIS CSCL 22A

The problems encountered and the experience gained in the entry mission plans, flight software, trajectory-monitoring procedures, and backup trajectory-control techniques of the Apollo Program should provide a foundation upon which future spacecraft programs can be developed. Descriptions of these entry activities are presented. Also, to provide additional background information needed for discussion of the Apollo entry experience, descriptions of the entry targeting for the Apollo 11 mission and the postflight analysis of the Apollo 10 mission are presented. Author

N72-20842*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: THERMAL DESIGN OF APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE
Robert S. Harris, Jr. Washington Mar. 1972 26 p refs
(NASA-TN-D-6738; MSC-S-310) Avail: NTIS CSCL 03B

The evolution of the thermal design of the Apollo lunar surface experiments package central station from the basic concept to the final flight hardware is discussed, including results of development, prototype, and qualification tests that were used to verify that the flight hardware would operate adequately on the lunar surface. In addition, brief discussions of the thermal design of experiments included in the experiments package are presented. The flight thermal performance is compared with analytical results and thermal-vacuum test results, and design modifications for future lunar surface experiment packages are presented. Author

N72-20843*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: ONBOARD NAVIGATIONAL AND ALIGNMENT SOFTWARE
Robert T. Savely, Bedford F. Cockrell, and Samuel Pines (Analytical Mechanics Associates, Inc.) Washington Mar. 1972 14 p refs
(NASA-TN-D-6741; MSC-S-317) Avail: NTIS CSCL 22B

The onboard navigational and alignment routines used during the nonthrusting phases of an Apollo mission are discussed as to their limitations, and alternate approaches that have more desirable capabilities are presented. A more efficient procedure for solving Kepler's equation, which is used in the calculation of Kepler's problem and Lambert's problem is included, and a sixth-order predictor scheme with a Runge-Kutta starter is recommended for numerical integration. The extension of the rendezvous navigation state to include angle biases and the use of a fixed coordinate system is also evaluated. Author

N72-20844*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: VOICE COMMUNICATIONS TECHNIQUES AND PERFORMANCE
John H. Dabbs and Oron L. Schmidt Washington Mar. 1972 18 p ref
(NASA-TN-D-6739; MSC-S-313) Avail: NTIS CSCL 17B

The primary performance requirement of the spaceborne Apollo voice communications system is percent word intelligibility, which is related to other link/channel parameters. The effect of percent word intelligibility on voice channel design and a description of the verification procedures are included. Development and testing performance problems and the techniques used to solve the problems are also discussed. Voice communications performance requirements should be comprehensive and verified easily; the total system must be considered in component design, and the necessity of voice processing and the associated effect on noise, distortion, and cross talk should be examined carefully. Author

N72-20845*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: LUNAR MODULE ENVIRONMENTAL CONTROL SUBSYSTEM
Richard J. Gillen, James C. Brady, and Frank Collier Washington Mar. 1972 50 p
(NASA-TN-D-6724; MSC-S-296) Avail: NTIS CSCL 22B

A functional description of the environmental control subsystem is presented. Development, tests, checkout, and flight experiences of the subsystem are discussed; and the design fabrication, and operational difficulties associated with the various components and subassemblies are recorded. Detailed

information is related concerning design changes made to, and problems encountered with, the various elements of the subsystem, such as the thermal control water sublimator, the carbon dioxide sensing and control units, and the water section. The problems associated with water sterilization, water/glycol formulation, and materials compatibility are discussed. The corrective actions taken are described with the expection that this information may be of value for future subsystems. Although the main experiences described are problem oriented, the subsystem has generally performed satisfactorily in flight. Author

N72-20846*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: CREW PROVISIONS AND EQUIPMENT SUBSYSTEM
Fred McAllister Washington Mar. 1972 59 p refs
(NASA-TN-D-6737; MSC-S-290) Avail: NTIS CSCL 22B

A description of the construction and use of crew provisions and equipment subsystem items for the Apollo Program is presented. The subsystem is composed principally of survival equipment, bioinstrumentation devices, medical components and accessories, water- and waste-management equipment, personal-hygiene articles, docking aids, flight garments (excluding the pressure garment assembly), and various other crew-related accessories. Particular attention is given to items and assemblies that presented design, development, or performance problems: the crew optical alinement sight system, the metering water dispenser, and the waste-management system. Changes made in design and materials to improve the fire safety of the hardware are discussed. Author

N72-20847*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACE SHUTTLE AEROTHERMODYNAMICS TECHNOLOGY CONFERENCE. VOLUME 1: FLOW FIELDS
Washington Feb. 1972 266 p refs Conf. held at Moffett Field, Calif., 15-16 Dec. 1971
(NASA-TM-X-2506; L-8136-Vol-1) Avail: NTIS CSCL 22B

A space shuttle technology conference was held to review the broad base of aerothermodynamics technology developed for the space shuttle during the period of Phase B and, thereby, help focus attention on the technology required for further space shuttle development. Volume 1 covers research related to flow fields. For individual titles, see N72-20848 through N72-20855.

N72-20848*# National Aeronautics and Space Administration, Washington, D.C.
SHUTTLE PROGRAM STATUS
Edward P. Andrews *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 1-40 refs (See N72-20847 11-31)
Avail: NTIS CSCL 22B

The status of the space shuttle phase of the space transportation system is reviewed by the use of a series of graphs and slides. Briefly described are: space shuttle capabilities and configurations; launch vehicles; mission profiles; recovery concepts; cost comparisons; program schedules; and benefits of reusable space transportation system. A.L.

N72-20849*# Northrop Corp., Hawthorne, Calif.
DETERMINATION OF SPACE SHUTTLE FLOW FIELD BY THE THREE-DIMENSIONAL METHOD OF CHARACTERISTICS c12
Chong-Wei Chu and S. A. Powers *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 47-64 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

The newly improved three-dimensional method of characteristics program has been applied successfully to the calculation of flow fields over a variety of bodies including slab delta wings and shuttle orbiters. Flow fields over fuselage shapes for Mach numbers as low as 1.5 have been calculated. Some typical results are presented. Author

N72-20850*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF SHOCK CAPTURING AND CHARACTERISTICS METHODS TO SHUTTLE FLOW FIELDS c12
P. Kutler, J. V. Rakich, and G. G. Mateer *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 65-92 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

The calculation of real gas flows around the space shuttle vehicle can be accomplished by the method of characteristics (MOC) or shock capture technique (SCT). Results obtained with these methods for an early orbiter shape proposed by the North American Rockwell Corporation and also for the more recent 040A configuration suggested by NASA-MSC are presented. Results obtained with the SCT code demonstrate its three-dimensional, multiple shock capturing capability while results obtained with the MOC code demonstrate the calculation of equilibrium real gas flows and the determination of flow variables required for a heating analysis. Author

N72-20851*# Lockheed Missiles and Space Co., Palo Alto, Calif.
FLOW FIELD PREDICTIONS FOR A SLAB DELTA WING AT INCIDENCE c12
R. J. Conti, P. D. Thomas, and Y. S. Chou *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 93-114 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

Theoretical results are presented for the structure of the hypersonic flow field of a blunt slab delta wing at moderately high angle of attack. Special attention is devoted to the interaction between the boundary layer and the inviscid entropy layer. The results are compared with experimental data. The three-dimensional inviscid flow is computed numerically by a marching finite difference method. Attention is concentrated on the windward side of the delta wing, where detailed comparisons are made with the data for shock shape and surface pressure distributions. Surface streamlines are generated, and used in the boundary layer analysis. The three-dimensional laminar boundary layer is computed numerically using a specially-developed technique based on small cross-flow in streamline coordinates. In the rear sections of the wing the boundary layer decreases drastically in the spanwise direction, so that it is still submerged in the entropy layer at the centerline, but surpasses it near the leading edge. Predicted heat transfer distributions are compared with experimental data. Author

N72-20852*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE ORBITER REENTRY FLOW FIELD AND HEATING ANALYSIS c12
W. C. Rochelle (TRACOR, Inc., Austin, Tex.), B. B. Roberts, F. W. Vogenitz (TRW Systems), and L. Dattorre (TRW Systems) *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 115-156 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

The reentry flow field and thermal environment around the straight wing shuttle orbiter vehicle were determined. Both rarefied and continuum flow fields and associated heating rates on various configurations representative of the orbiter at high angle of attack were calculated. Rarefied flow fields and heating rates were computed by the Monte Carlo direct simulation technique for altitudes above 82.3 km. Continuum inviscid flow fields were calculated by 2-D unsteady and 3-D steady finite difference/artificial viscosity methods and also by a 2-D shock layer analysis technique. Viscous flow fields and heating rates in the continuum regime were computed by a boundary layer integral matrix method for laminar flow and by an aerodynamic surface heating technique for turbulent flow. Shapes considered in the study included flat plates (representing the underside of the orbiter fuselage or the wing MAC), orbiter fuselage cross sections, orbiter wing airfoils, and 3-D orbiter configurations, all at high angle of attack (40 - 60 deg). The theoretical results

showed good agreement with measured pressure and heat transfer data. Author

N72-20853*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A VISCOUS STARTER SOLUTION FOR SHUTTLE FLOW FIELD COMPUTATIONS c12
C. P. Li (Lockheed Elec. Co., Inc.) and W. D. Goodrich *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 157-184 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

A time dependent numerical procedure that calculates the viscous flow in the shock layer around the shuttle nose has been developed. It has been applied to the free stream conditions that may be encountered in the shuttle flight trajectory and found to be efficient and in satisfactory agreement with other steady and unsteady techniques. Two features associated with the present formulation are responsible for its successful applications. The first is that the flow field computation is made within the shock layer; the second is that the mapping of the computational region places proportionately more mesh points in the vicinity of the wall than in the remaining computational region. The numerical results may be used for low altitude flight to determine the edge conditions for a thin boundary layer, to provide initial boundary layer profiles for downstream boundary layer calculations, and to start supersonic computations. For high altitude flight, it may be used to determine the complete flow field in the nose region and also provide a starter solution for subsequent supersonic flow computations. Author

N72-20854*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHEMICAL NONEQUILIBRIUM EFFECTS ON THE FLOW IN THE WINDWARD PLANE OF SYMMETRY OF A BLUNTED DELTA ORBITER c12
J. A. Lordi (Cornell Aeron. Lab., Inc.), R. J. Vidal (Cornell Aeron. Lab., Inc.), and C. B. Johnson *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 185-238 refs (See N72-20847 11-31)
Avail: NTIS CSCL 20D

The extent, and some of the consequences, of nonequilibrium effects in the inviscid orbiter flow field are examined. Calculations have been made for the reacting flow along selected streamlines in the windward plane of symmetry of a blunted delta shape representative of a shuttle orbiter. An approximate model of the pressure field in the windward plane of symmetry of a blunted delta wing was constructed from wind tunnel measurements of the body surface pressure distribution and approximate calculations of the shock shape and streamline locations. Numerical solutions for the flow along streamlines were obtained for this pressure distribution, and solutions were obtained for both equilibrium and finite-reaction rate, nonequilibrium chemical reactions. Since the streamtube solutions are much easier to compute than fully three-dimensional, reacting flows, results were obtained for a wide range of conditions. The validity of this approach is based on the assumptions that the pressure field is insensitive to nonequilibrium effects and that the flow along streamlines is quasi-one dimensional. Numerical solutions have been used to verify this approach for other blunted slender shapes such as spherically blunted cones. Author

N72-20855*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVISCID SURFACE STREAMLINE PROGRAM FOR USE IN PREDICTING SHUTTLE HEATING RATES c12
In its Space Shuttle Aerothermodyn. Technol. Conf., vol. 1 Feb. 1972 p 239-254 refs (See N72-20847 11-31)
(Contract NAS1-10277)
Avail: NTIS CSCL 20D

A number of methods are currently under development for computing the exact three-dimensional flow field about real configurations. However, even when these methods are available, they will require large computational times on present generation computers. Thus, there is still a need to develop approximate methods to solve three-dimensional flow problems. An inviscid-surface-streamline program (for predicting shuttle heating rates) which uses approximate methods to obtain a solution is described. Author

N72-20856*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACE SHUTTLE AEROTHERMODYNAMICS TECHNOLOGY CONFERENCE. VOLUME 2: HEATING
Washington Feb. 1972 451 p refs Conf. held at Moffett Field, Calif., 15-16 Dec. 1971
(NASA-TM-X-2507; L-8136-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Summaries of aerothermodynamics technology, developed for space shuttles, space shuttle orbiters, and space shuttle engines, are given. Special attention is given to turbulent heat transfer on the windward surface, flow on the lee surface, boundary layer transition, and methods for measuring heat transfer. For individual titles, see N72-20857 through N72-20870.

N72-20857*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL AND THEORETICAL AERODYNAMIC HEATING AND FLOW FIELD ANALYSIS OF A SPACE SHUTTLE ORBITER c33
R. K. Matthews, T. D. Buchanan, W. R. Martindale, and J. D. Warmbrod *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 261-296 refs Prepared in cooperation with Aro, Inc. (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

The results of work on the McDonnell Douglas delta wing orbiter are summarized and compared to other data and theories where applicable. The tests were conducted in the continuous hypersonic Tunnel B at Mach 8 and in the hypervelocity hotshot Tunnel F at Mach 10.5. Photographic data are used to illustrate the regions of peak heating on the lee-side and to show the vortical nature of the flow. Windward centerline data include measurements of shock angle, surface pressure, flow field pitot pressure and total temperature, and heat transfer rate coefficient distributions. Shock angles, surface pressures, and local Mach number distributions are compared with tangent cone theory over an angle of attack range from 10 to 60 deg. The measured heat transfer rate coefficient distributions are compared to both laminar and turbulent theories and boundary layer transition data are compared to the McDonnell Douglas criteria. Author

N72-20858*# Grumman Aerospace Corp., Bethpage, N.Y.
A REVIEW OF THE GRUMMAN ORBITER WIND TUNNEL HEAT TRANSFER TESTS c33
A. R. Mendelsohn, M. Bourbin, M. Jew, and C. W. Osonitsch *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 297-345 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

Tests were conducted in the NASA Langley continuous flow, variable density and Mach 20 helium tunnels. The orbiter was tested alone and with various side and tandem mounted tanks. Test conditions spanned a Reynolds number range which resulted in both laminar and turbulent flows. Experimental studies also examined the heat transfer problems associated with integration of the auxiliary propulsion system into the orbiter. Tests in the hypersonic shock tunnel investigated heating to cavities and heating from single and multiple hydrogen-oxygen plumes while tests, run as part of the configuration evaluation, examined the heating to wing pods. Author

N72-20859*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH REYNOLDS NUMBER TURBULENT HEATING TO TWO SIMPLIFIED SHUTTLE CONFIGURATIONS c33

Charles B. Johnson *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 347-373 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

Turbulent heating and transition data, taken from three test facilities, for two space shuttle configurations are presented. Major efforts were on: (1) the effect of the two geometries having different amounts of cross flow and how the different cross flows affect heating and transition, (2) the experimental level of turbulent heating and the ability to predict the level of turbulent heating, and (3) a comparison of the transitional and turbulent heating in three facilities with two model scale sizes to investigate the facility effects and scale-size effect on transition and turbulent heating. The three facilities in which the configurations were tested are the Langley Mach 8 variable-density hypersonic tunnel and the Arnold Engineering Development Center tunnel B and tunnel F at Mach numbers of 8 and 10.5, respectively. Author

N72-20860*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF ROUGHNESS ON HEATING AND BOUNDARY-LAYER TRANSITION. PART 1: EFFECTS OF SIMULATED PANEL JOINTS ON BOUNDARY-LAYER TRANSITION **c33**
H. Lee Seegmiller *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 375-394 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

The effects of distributed roughness, arising from space shuttle orbiter panel joints, on boundary layer transition are investigated. The North American Rockwell 134B delta wing shuttle configuration was used for the study. Results show: (1) Premature boundary layer transition occurred in models having simulated heat shield panels with rased joints. (2) Laminar flow was maintained with slot type panel joint models to a Reynolds number twice that at which transition occurred in raised joints. (3) Significant increases in peak surface temperature and the time during which turbulent flow occurs may result from distributed roughness of heat shield panel joints. (4) Laminar and turbulent heating levels were predicted within available theories. (5) A complex interference between the wing and fuselage flow was observed in the delta wing model. E.H.W.

N72-20861*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF ROUGHNESS ON HEATING AND BOUNDARY-LAYER TRANSITION. PART 2: EFFECTS OF DISCRETE ROUGHNESS ON HEATING **c33**
George G. Mateer *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 395-411 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

A preliminary investigation on the effects of roughness on heating in delta wing orbiters was conducted on the windward surface of the vehicle. The purpose of the experiment was to determine the feasibility of using parametric relationships obtained from discrete roughnes effects on heating in flat plates and cones, to complex shuttle configurations. An attempt was also made to characterize what parameters were needed to influence roughness. Experimental results show that effective roughness Reynolds numbers are less than or equal to those of flat plates at the same edge Mach number, but, the roughness correlations for plates and cones cannot be applied to the shuttle configuration. E.H.W.

N72-20862*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LEE-SIDE FLOW PHENOMENA ON SPACE SHUTTLE CONFIGURATIONS AT HYPERSONIC SPEEDS. PART 1: FLOW SEPARATION AND FLOW FIELD VISCOUS PHENOMENA OF A DELTA-WING SHUTTLE ORBITER CONFIGURATION **c33**
J. W. Cleary *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 413-449 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

Results of a pitot pressure investigation of the flow field on the lee side of a delta wing shuttle orbiter are presented. The results delineate the extent of the lee side separated flow and give a tentative cross sectional definition to the shock wave structure for angles of attack of 15 deg and 30 deg. It is shown that while, in general, the effects of Reynolds number on the flow field are not large, detailed effects are observed that may have significant bearing on the heating estimate. Two examples are cited for an angle of attack of 15 deg; these are: (1) The scope of the vertical tail exposed to the unseparated flow increases with increasing Reynolds number and (2) the depth of the separated flow adjacent ot where the bow wave crosses the wing appears to decrease with increasing Reynolds number. In addition, it is shown that at a spanwise station outboard of the wing-fuselage juncture, increasing Reynolds number decreased the pitot pressure in the unseparated flow. This defect of pitot pressure appears associated with the flow over the wing-fillet-fuselage juncture. Author

N72-20863*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LEE-SIDE FLOW PHENOMENA ON SPACE SHUTTLE CONFIGURATIONS AT HYPERSONIC SPEEDS. PART 2: STUDIES OF LEE-SURFACE HEATING AT HYPERSONIC MACH NUMBERS **c33**
Jerry N. Hefner and Allen H. Whitehead, Jr. *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 451-467 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

Lee surface heating data, obtained at relatively low unit Reynolds numbers at Mach 6 and 19, are discussed with emphasis on the peak heating behavior. Surface pressures measured along the lee meridian of the delta-wing orbiter are presented and analyzed in conjunction with the heating. The effects of nose bluntness and lee surface geometry on the heating are discussed and general guidelines are presented for modifying the lee surface geometry of the shuttle to reduce vortex-induced heating. The application of the wind tunnel results to realistic shuttle flight conditions is discussed. Author

N72-20864*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AEROTHERMODYNAMIC MEASUREMENTS FOR SPACE SHUTTLE CONFIGURATION IN HYPERSONIC WIND TUNNELS **c33**
John J. Bertin (Texas Univ., Austin), Frank E. Williams (Texas Univ., Austin), Robert C. Baker (Texas Univ., Austin), Winston D. Goodrich, and William C. Kessler (McDonnel-Douglas Astronaut. Corp., St. Louis) *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 469-501 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

The effect of shuttle configuration geometry, angle of attack, and free stream flow conditions on the heat-transfer distribution as influenced by three-dimensional effects, the wing-fuselage shock-interaction, and resultant wing-impingement phenomena are examined. In addition, the data provided information regarding the flow field in the vicinity of the nose and boundary layer transition in the plane of symmetry of the fuselage. The data included measurements of the surface pressure, the heat transfer rate distributions, (using models instrumented with thermocouples and models painted with thermographic phosphor) and schlieren and shadowgraph photographs. Posttest photographs of the painted models supplemented the heat transfer data. Author

N72-20865*# North American Rockwell Corp., Downey, Calif. Space Div.
DETERMINATION OF AEROTHERMODYNAMIC ENVIRON-

MENT UNCERTAINTIES WITH APPLICATION TO SPACE SHUTTLE VEHICLES **c33**

C. A. Scottoline *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 503-518 refs (See N72-20856 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

In an effort to minimize the cost of the thermal protection system (TPS) for space shuttles, an analysis is made of environmental uncertainties. The basic categories of these uncertainties include aerodynamic heating, trajectory dispersions, atmospheric variations, and vehicle attitude variations. Also discussed are TPS design sensitivity to environmental uncertainties, and uncertainty profiles. Preliminary results indicate moderate TPS cost for a high confidence level environment may be obtained. E.H.W

N72-20866*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

SPACE SHUTTLE BOOSTER MULTI-ENGINE BASE FLOW ANALYSIS **c12**

Homer H. Tang, Charles R. Gardiner, William A. Anderson, and Jhon Navickas *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 519-605 refs (See N72-20856 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 20D

A comprehensive review of currently available techniques pertinent to several prominent aspects of the base thermal problem of the space shuttle booster is given along with a brief review of experimental results. A tractable engineering analysis, capable of predicting the power-on base pressure, base heating, and other base thermal environmental conditions, such as base gas temperature, is presented and used for an analysis of various space shuttle booster configurations. The analysis consists of a rational combination of theoretical treatments of the prominent flow interaction phenomena in the base region. These theories consider jet mixing, plume flow, axisymmetric flow effects, base injection, recirculating flow dynamics, and various modes of heat transfer. Such effects as initial boundary layer expansion at the nozzle lip, reattachment, recompression, choked vent flow, and nonisoenergetic mixing processes are included in the analysis. A unified method was developed and programmed to numerically obtain compatible solutions for the various flow field components in both flight and ground test conditions. Preliminary prediction for a 12-engine space shuttle booster base thermal environment was obtained for a typical trajectory history. Theoretical predictions were also obtained for some clustered-engine experimental conditions. Results indicate good agreement between the data and theoretical predicitons. Author

N72-20867*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN ANALYSIS OF THE BOOSTER PLUME IMPINGEMENT ENVIRONMENT DURING THE SPACE SHUTTLE NOMINAL STAGING MANEUVER **c33**

C. J. Wojciechowski (Lockheed Missiles and Space Co., Inc., Huntsville, ala.), M. M. Penny (Lockheed Missiles and Space Co., Inc., Huntsville, Ala.), T. F. Greenwood, and I. H. Fossler *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 607-644 refs (See N72-20856 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

An experimental study of the plume impingement heating on the space shuttle booster afterbody resulting from the space shuttle orbiter engine plumes was conducted. The 1/100-scale model tests consisted of one and two orbiter engine firings on a flat plate, a flat plate with a fin, and a cylinder model. The plume impingement heating rates on these surfaces were measured using thin film heat transfer gages. Results indicate the engine simulation is a reasonable approximation to the two engine configuration, but more tests are needed to verify the plume model of the main engine configuration. For impingment, results show models experienced laminar boundary layer convective heating. Therefore, tests at higher Reynolds numbers are needed to determine impingment heating. Author

N72-20868*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONVECTIVE HEATING MEASUREMENT BY MEANS OF AN INFRARED CAMERA **c14**

Dale L. Compton *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 645-660 ref (See N72-20856 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

The development of rapid and accurate wind tunnel techniques to measure convective heating distributions in complex reentry configurations is discussed. Major emphasis was put on the infrared camera technique. Its essence is the measurement of infrared emission from the surface of a wind tunnel model as a function of time. Prior calibration of the infrared camera relates the emission to the surface temperature of the model. The time history of the surface temperature can then be related to the heating rate by standard techniques. The output of the camera is an electrical signal that is tape-recorded in analog form, then digitized and processed by computer, so that automated and relatively rapid data reduction can be accomplished. In addition, the camera produces real-time visual displays of the infrared emission as pictures on an oscilloscope screen. These pictures give immediate indications of hot and cool spots on the model. Author

N72-20869*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HEAT-TRANSFER TESTING PROCEDURES IN PHASE B SHUTTLE STUDIES WITH EMPHASIS ON PHASE CHANGE DATA IMPROVEMENT **c33**

David A. Throckmorton *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 661-682 (See N72-20856 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

The procedures used in the application of the phase change technique to the phase B shuttle configuration are discussed along with factors which may affect data accuracy. These factors include variation of thermal properties of phase change model material, sensitivity of measured heat transfer coefficients to the assumed value of the adiabatic to total temperature ratio, and wall temperature effects. These sensitivities are illustrated in sample calculations for a shuttle geometry. Factors which may affect the visual clarity and interpretation of phase change data are discussed, and a method of improving photographic data quality through the use of polarized light is presented. Author

N72-20870*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EVALUATION OF BOUNDARY LAYER TRANSITION CRITERIA FOR SPACE SHUTTLE ORBITER ENTRY **c12**

Vernon T. Helms, III *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 683-704 refs (See N72-20856 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 20D

A comparison was made of the effect of boundary layer transition on center-line heating in a conical and a normal-shock flow field. It was shown that the time of transition onset (and, hence, the heating parameter) is significantly influenced by the choice of transition criterion in the normal-shock flow but that this parameter is much less sensitive to the transition criterion in a conical flow field. An evaluation of the effects of boundary layer transition on center-line heating in the conical flow field has shown that the temperatures are less affected by the use of various transition crieria than are heat loads. This difference is due to the delay in the time of transition onset predicted by those criteria with high transition Reynolds numbers. The criteria which predict the most severe thermal environment are those of fully turbulent flow throughout the entry, because transition occurs early in the trajectory for each of these criteria, they tend to predict similar values of maximum temperature and total heat load especially at center-line locations aft of 0.6. Evaluation of center-line heating generated by various trajectory shaping approaches has shown that the maximum surface temperature distribution was not significantly affected by the shaping technique.

However, the heat load distribution is influenced, particularly on the forward portion of the vehicle. Author

N72-20871*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACE SHUTTLE AEROTHERMODYNAMICS TECHNOLOGY CONFERENCE. VOLUME 3: AERODYNAMICS
Washington Feb. 1972 296 p refs Conf. held at Moffett Field, Calif., 15-16 Dec. 1971
(NASA-TM-X-2508; L-8136-Vol-3) Avail: NTIS CSCL 20M

The conference papers presented are primarily concerned with the aerodynamics of complete configurations. A wide range of aerodynamic considerations are covered that deal with both the static and dynamic characteristics of several concepts. Treatment is given the orbiters and boosters as separate flight vehicles, and with the vehicles mated into the launch vehicle system. For individual titles, see N72-20872 through N72-20879.

N72-20872*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATUS OF LANGLEY STUDIES OF AERODYNAMICS AND INTERFERENCE EFFECTS OF TANDEM LAUNCH VEHICLES
William I. Scallion and Kermit G. Pratt *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 707-736 ref (See N72-20871 11-31)
Avail: NTIS CSCL 22B

Some of the aerodynamic and interference effects measured from wind-tunnel tests of three fully reusable space shuttle configurations at transonic and low-supersonic speeds are presented, and the status is given of an assessment of the analytical approach to date. The three configurations tested were a low-fineness-ratio booster combined in tandem with a delta-wing orbiter, designated the 'low-fineness-ratio configuration,' and a phase B shuttle configuration consisting of the delta-wing orbiter and high-fineness-ratio booster, designated the 'stage-arrangement configuration,' arranged in tandem and in parallel. The force measurements obtained at a Mach number of 1.5 for the low-fineness-ratio configuration were representative of the transonic and low-supersonic speed ranges where the interference effects are predominant and were used for comparison with values calculated at the same Mach number. This comparison is the basis for a preliminary assessment of the initial application of the analytical approach. Author

N72-20873*# McDonnell-Douglas Co., Long Beach, Calif.
IMPACT OF SUBSONIC AERODYNAMIC CONSIDERATIONS ON A SPACE SHUTTLE BOOSTER CONFIGURATION
R. L. Roensch and R. L. Denbaugh (McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.) *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 737-784 (See N72-20871 11-31)
Avail: NTIS CSCL 22B

Considerations of cruise-back efficiency and subsonic flying qualities are shown to have resulted in a configuration with an aft high wing of moderate aspect ratio and with vertical tails located at the wing tips. The need to protect the air breathing engines during ascent and reentry and the desire for a low trim penalty longitudinal control surface led to consideration of a jet-flap canard. The advantages of this application of STOL technology to a space system are examined and the results of both wind tunnel tests and flight simulations are discussed. Since the use of the jet-flap canard concept offers the potential for a minimum weight vehicle, a proposed technology development program is outlined in order that the full benefit of this concept may be realized. Author

N72-20874*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC STUDIES OF DELTA-WING SHUTTLE ORBITERS. PART 1: LOW SPEED
Delma C. Freeman, Jr. and James C. Ellison *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 785-802 (See N72-20871 11-31)
Avail: NTIS CSCL 22B

Numerous wind tunnel tests conducted on the evolving delta-wing orbiters have generated a fairly large aerodynamic data base over the entire entry operation range of these vehicles. A limited assessment is made of some of the aerodynamics of the current HO type orbiters, and several specific problem areas selected from the broad data base are discussed. These include, from a subsonic viewpoint, discussions of trim drag effect; effects of the installation of main rocket engine nozzles, OMS and RCS packages, Reynolds number effects, lateral-directional stability characteristics, and landing characteristics. D.L.G.

N72-20875*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC STUDIES OF DELTA-WING SHUTTLE ORBITERS. PART 2: HYPERSONICS
Howard W. Stone and James P. Arrington *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 803-830 (See N72-20871 11-31)
Avail: NTIS CSCL 22B

An early version of an external hydrogen-oxygen tank orbiter was used as a baseline vehicle to experimentally evaluate: (1) nose shape and canopy effects on longitudinal, lateral, and directional stability and trim, and (2) yaw due to aerodynamic roll control at hypersonic speeds. Nose alterations were examined since that part of the vehicle may be subject to modifications because of internal packaging requirements, alleviation of potential high heating areas, and/or possible improvements in aerodynamic stability and control. There was also some concern about the effect of the rather high profile canopy on the aerodynamics; therefore its removal was examined. In addition, roll-yaw coupling was investigated because of its impact on the RCS fuel requirements for entry maneuvers. Author

N72-20876*# North American Rockwell Corp., Downey, Calif. Space Div.
WING OPTIMIZATION FOR SPACE SHUTTLE ORBITER VEHICLES
T. E. Surber, W. E. Bornemann, and W. D. Miller *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 831-860 (See N72-20871 11-31)
Avail: NTIS CSCL 22B

The results were presented of a parametric study performed to determine the optimum wing geometry for a proposed space shuttle orbiter. The results of the study establish the minimum weight wing for a series of wing-fuselage combinations subject to constraints on aerodynamic heating, wing trailing edge sweep, and wing over-hang. The study consists of a generalized design evaluation which has the flexibility of arbitrarily varying those wing parameters which influence the vehicle system design and its performance. The study is structured to allow inputs of aerodynamic, weight, aerothermal, structural and material data in a general form so that the influence of these parameters on the design optimization process can be isolated and identified. This procedure displays the sensitivity of the system design of variations in wing geometry. The parameters of interest are varied in a prescribed fashion on a selected fuselage and the effect on the total vehicle weight is determined. The primary variables investigated are: wing loading, aspect ratio, leading edge sweep, thickness ratio, and taper ratio. Author

N72-20877*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
REVIEW OF DELTA WING SPACE SHUTTLE VEHICLE DYNAMICS
J. Peter Reding and Lars E. Ericsson *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 861-932 refs (See N72-20871 11-31)
(Contract NAS9-11445)

Avail: NTIS CSCL 22B

The unsteady aerodynamics of the delta planform, high cross range, shuttle orbiter were investigated. It has been found that these vehicles are subject to five unsteady flow phenomena that could compromise the flight dynamics. They are: (1) leeside shock induced separation, (2) sudden leading edge stall, (3) vortex burst, (4) bow shock-flap shock interaction, (5) forebody vorticity. Trajectory shaping is seen as the most powerful means of avoiding the detrimental effects of the stall phenomena. However, stall must be fixed or controlled when traversing the stall region. The other phenomena may be controlled by carefully programmed control deflections and some configuration modification. Ways to alter the occurrence of the various flow conditions are explored. Author

N72-20878*# National Research Council of Canada, Ottawa (Ontario).

EXPERIMENTS ON THE DYNAMIC STABILITY OF THE SPACE SHUTTLE

K. J. Orlik-Rueckemann, J. G. LaBerge, and E. S. Hanff *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 933-968 refs (See N72-20871 11-31)

Avail: NTIS CSCL 22A

Some dynamic stability experiments on the space shuttle using a half-model oscillatory technique are discussed. Resulting information from the experiments is presented and includes: (1) dynamic pitching characteristics of both the orbiter and the booster alone as well as of the two models mated into a single launch configuration; (2) the static and dynamic interference effects during an abort separation maneuver; and (3) the dynamic plume interference effect. D.L.G.

N72-20879*# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

AEROSPACE TRANSPORTER AND LIFTING BODY ACTIVITIES IN EUROPE AND POTENTIAL PARTICIPATION IN THE DEVELOPMENT OF THE SPACE SHUTTLE ORBITER

M. Fuchs, J. Haseloff, and G. Peters *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 3 Feb. 1972 p 969-995 (See N72-20871 11-31)

Avail: NTIS CSCL 22B

The course of European aerospace research regarding reentry problems is briefly reviewed for the period from 1966 up to the present. The considerable experience gained by Europe, and particularly Germany, is shown to have led to their involvement and participation in the U.S. space shuttle program. The areas of investigation and expected contributions by European cooperation in the shuttle program are outlined. D.L.G.

N72-20880*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SPACE SHUTTLE AEROTHERMODYNAMICS TECHNOLOGY CONFERENCE. VOLUME 4: OPERATIONAL FLIGHT MECHANICS

Washington Feb. 1972 481 p refs Conf. held at Moffett Field, Calif., 15-16 Dec. 1971 4 Vol.

(NASA-TM-X-2509; L-8136-Vol-4) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The proceedings of a conference on space shuttle aerothermodynamics technology are presented. Emphasis is placed on the operational flight mechanics of the space shuttle. Subjects discussed are: (1) vehicle performance impact on space shuttle design and concept evaluation, (2) atmospheric ascent flight dynamics, (3) optimal lifting ascent trajectories, (4) stage separation of parallel-staged shuttle vehicles (5) orbiter entry trajectory considerations, and (6) optimized space shuttle trajectory simulation. For individual titles, see N72-20881 through N72-20892.

N72-20881*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

VEHICLE PERFORMANCE IMPACT ON SPACE SHUTTLE DESIGN AND CONCEPT EVALUATION

Mark K. Craig *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 999-1039 (See N72-20880 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The continuing examination of widely varied space shuttle concepts makes an understanding of concept interaction with vehicle performance imperative. The estimation of vehicle performance is highly appurtenant to all aspects of shuttle design and hence performance has classically been a key indicator of overall concept desirability and potential. Vehicle performance assumes the added role of defining interactions between specific design characteristics, the sum total of which define a specific concept. Special attention is given to external tank effects. Author

N72-20882*# Boeing Co., Seattle, Wash.

SPACE SHUTTLE ATMOSPHERIC ASCENT FLIGHT DYNAMICS

J. T. Patha, K. A. Noess, and M. V. Lines *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1041-1062 ref (See N72-20880 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

The atmospheric ascent flight phase of the mated composite booster and orbiter is discussed. The composite recoverable space shuttle booster and orbiter exhibits unique flight control characteristics. This uniqueness results from large lifting surfaces and aerodynamic and structural assymetrics. An effective load relief technique reduces aerodynamic loads on both the booster and the orbiter. Reducing aerodynamic loads permits decreasing the structural weight of the lifting and stabilizing surfaces. An orbiter payload penalty is caused by trajectory deviations resulting from load relief. However, the net effect of an effective load relief technique is an increase in payload capability. Atmospheric launch dynamics investigations have been carried out for different configuration types, which include expendable, straight wing, delta wing, and ballistic recoverable boosters. Author

N72-20883*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

OPTIMAL LIFTING ASCENT TRAJECTORIES FOR THE SPACE SHUTTLE **c30**

Timothy R. Rau and Jarrell R. Elliott *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1063-1087 refs (See N72-20880 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

The performance gains which are possible through the use of optimal trajectories for a particular space shuttle configuration are discussed. The spacecraft configurations and aerodynamic characteristics are described. Shuttle mission payload capability is examined with respect to the optimal orbit inclination for unconstrained, constrained, and nonlifting conditions. The effects of velocity loss and heating rate on the optimal ascent trajectory are investigated. Author

N72-20884*# North American Rockwell Corp., Downey, Calif. Space Div.

OPTIMAL ASCENT TRAJECTORIES OF A TWO STAGE SPACE SHUTTLE VEHICLE **c30**

R. A. Wilson *In* NASA. Langley Res. Center Space Shuttle Aerothemodyn. Tech. Conf., vol. 4 Feb. 1972 p 1089-1108 (See N72-20880 11-31)

Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

The effects of aerodynamic lift on the performance capability of a two stage space shuttle are discussed. The performance program uses three degrees of freedom to describe the trajectory of a point mass moving over the rotating earth. Two cases of ascent modes are described and compared. It is concluded that significant improvements in performance through the use of lift appear to be configuration dependent, and for this reason cannot be generalized for all spacecraft configurations. Author

N72-20885*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ABORT SEPARATION OF THE SHUTTLE **c30**
John P. Decker, Kenneth L. Blackwell, Joseph L. Sims, R. H. Burt (ARO), W. T. Strike, Jr. (ARO), C. Donald Andrews (Lockheed Missiles and Space Co., Huntsville, Ala.), L. Ray Baker, Jr. (Lockheed Missiles and Space Co., Huntsville, Ala.), and John M. Rampy (Northrop Corp., Huntsville, Ala.) *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1105-1164 refs (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

A sensitivity analysis of the factors which affect a successful abort maneuver following a space shuttle launching is presented. Wind tunnel tests were conducted using optimum simulation techniques and data acquisition procedures. Static stability, dynamic stability, and local loads were investigated. It is concluded that parallel abort separation of the space shuttle components is possible at both high and low dynamic pressures. Successful separation is dependent upon configuration, Mach number, rocket exhaust impingement and relative position and attitude of the stages. Author

N72-20886*# General Dynamics/Convair, San Diego, Calif.
BOOSTER RECOVERY FOLLOWING PREMATURE SPACE SHUTTLE STAGE SEPARATION **c30**
M. J. Hurley *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1165-1189 refs (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

Abort criteria necessary to satisfy space shuttle program requirements to include intact vehicle abort capability are discussed. Intact abort implies the ability of the booster and orbiter to separate and both continue flight to a safe landing, with a full payload aboard the orbiter. Obviously, the requirement to separate early along the ascent trajectory presupposes critical operational problems that are probably booster problems and may preclude booster recovery. On the other hand, some critical problems while mated can become manageable when separated and should result in full booster recovery. All critical orbiter problems fall into this category; since stage separation without orbiter thrust is a capability of some separation system concepts, booster stage recovery following separation is a requirement. Author

N72-20887*# General Dynamics/Convair, San Diego, Calif.
EFFECT OF COMMERCIAL AND MILITARY PERFORMANCE REQUIREMENTS FOR TRANSPORT CATEGORY AIRCRAFT ON SPACE SHUTTLE BOOSTER DESIGN AND OPERATION
R. A. Bithell and W. A. Pence, Jr. *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1191-1237 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The effect of two sets of performance requirements, commercial and military, on the design and operation of the space shuttle booster is evaluated. Critical thrust levels are established according to both sets of operating rules for the takeoff, cruise, and go-around flight modes, and the effect on engine requirements determined. Both flyback and ferry operations are considered. The impact of landing rules on potential shuttle flyback and ferry bases is evaluated. Factors affecting reserves are discussed, including winds, temperature, and nonstandard flight operations. Finally, a recommended set of operating rules is proposed for both flyback and ferry operations that allows adequate performance capability and safety margins without compromising design requirements for either flight phase. Author

N72-20888*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE SHUTTLE ORBITER HANDLING QUALITY CRITERIA APPLICABLE TO TERMINAL AREA, APPROACH, AND LANDING
Gordon H. Hardy *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1239-1263 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

An analytical pilot-vehicle study was made to determine the performance criteria for the space shuttle vehicle. Specifications for the flying qualities of piloted aircraft were used for appropriate portions of the space shuttle mission. The handling qualities during the terminal phases of the space shuttle flight were simulated to develop the necessary criteria. Additional criteria required for conditions during the unpowered approach and landing trajectory portion of the flight are explained. Author

N72-20889*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ORBITER ENTRY TRAJECTORY CONSIDERATIONS **c30**
John J. Rehder and Paul F. Holloway *In its* Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1265-1300 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

Space shuttle trajectory-shaping optimization considering the vehicle's thermal environment and the resulting requirements of the thermal protection system (TPS) are discussed. Optimization studies have been conducted yielding results which are generally applicable to shuttle orbiters and are independent of evolution and redirection of the space shuttle program. Two investigations of optimal trajectory shaping, with different methods of considering the thermal environment are presented. Author

N72-20890*# General Dynamics/Convair, San Diego, Calif.
STAGE SEPARATION OF PARALLEL-STAGED SHUTTLE VEHICLES, A CAPABILITY ASSESSMENT **c30**
M. J. Hurley and G. W. Carrie *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1301-1395 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

The separation concept for stage separation of parallel staged space shuttle vehicles is discussed. The forward link separation concept is emphasized. The effects of aerodynamic interference and component mass are analyzed. Qualitative measurements used to perform a preliminary evaluation of various separation system concepts are presented. Line drawings are included to clarify the mechanisms and spacecraft structures used in stage separation. Author

N72-20891*# General Dynamics/Fort Worth, Tex. Aerospace Div.
SPACE SHUTTLE BOOSTER FLYBACK SYSTEM SYNTHESIS **c30**
D. W. Jones, W. J. Moran, and V. A. Lee *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1397-1437 (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

One particular aspect of configuration development and evaluation for an earth-to-orbit reusable space transportation system is presented. It deals only with the first-stage booster element of the system. It is restricted to consideration of only those aspects of the booster which are associated with its capability to be recovered, the booster flyback system. A computerized synthesis approach for treating this problem is discussed. Author

N72-20892*# General Dynamics/Convair, San Diego, Calif.
OPTIMIZED SPACE SHUTTLE TRAJECTORY SIMULATION **c30**
Louis Tramonti and Richard G. Brusch *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Tech. Conf., vol. 4 Feb. 1972 p 1439-1473 refs (See N72-20880 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

A computer program for simulating optimized space shuttle trajectories is presented. The program considers the ascent, return, and synergetic maneuvers of lifting boosters and spacecraft.

Other constraints on optimum trajectory such as maximum heating, acceleration, angle of attack, and excluded or included overflight or impact regions are examined. Mathematical models are included to support the theoretical aspects of the discussion.
Author

N72-20893# Transportation Systems Center, Cambridge, Mass.
MULTIBEAM AERONAUTICAL SATELLITE SYSTEM DESIGN Technical Report, 1 Oct. - 31 Dec. 1971
L. M. Keane Dec. 1971 76 p refs
(DOT-TSC-FAA-71-30) Avail: NTIS

A method is described which allows the identification of favored beam distributions for multiple beam aeronautical satellites. It is used to synthesize beam designs and compare the capacities of two satellite system configurations which cover the major Pacific routes. The first configuration has two satellites with eclipse capability adequate for housekeeping and independent aircraft surveillance; the second has additional battery capacity to provide 50% of the daylight communications capability in each satellite during eclipse. In this case, each satellite covers a limited portion of the full coverage area. Author

N72-20894# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, AUGUST 1971
R. D. Eberst 9 Nov. 1971 18 p
(ROE-STS-117) Avail: NTIS

Stopwatch observations made at stations connected with the section during August 1971 are listed in launch and time order for each satellite. Various subtotals are given. ESRO

N72-20895# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, SEPTEMBER 1971
R. D. Eberst 9 Dec. 1971 32 p
(ROE-STS-118) Avail: NTIS

Stopwatch observations made at stations connected with the section during September 1971 are listed in launch and time order for each satellite. Various subtotals are given. ESRO

N72-20896# Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).
MISSION SEQUENCE AND GROUND HANDLING SYSTEM OF THE FIRST GERMAN-AMERICAN INTERPLANETARY PROBES HELIOS A AND B IN THE PLANNING STAGE [MISSION SABLAUF UND BODENBETRIEBSSYSTEM DER ERSTEN DEUTSCH-AMERIKANISCHEN INTERPLANETAREN SONDEN HELIOS A UND B IN DER PLANUNG]
H. J. Panitz Cologne DGLR 1971 22 p In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

Aspects of the planning of the mission of the Helios solar probe are discussed. Provisional orbit parameters show how the mission and its characteristics and the possible ground network have influenced the Helios system and how these capabilitites and limits have led to a global concept for Helios operations. The antenna and attitude control systems of the probe are discussed and the needs for telemetry, tracking, and command are analyzed. ESRO

N72-20049*# National Aeronautics and Space Administration, Washington, D.C.
BIOSATELLITE 2: THE NATION'S FIRST BIOLOGY LABORATORY IN SPACE
Joseph F. Saunders, Orr E. Reynolds, and G. Dale Smith (Calif. Univ., Berkeley) *In its* The Expt. of Biosatellite 2 1971 p 1-14 refs (See N72-20048 11-04)
Avail: NTIS; SOD $3.50 CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-20897*# Wiggins (J. H.) Co., Inc., Palos Verdes Estates, Calif.
STRUCTURAL MODEL OPTIMIZATION USING STATISTICAL EVALUATION Interim Report
Jon D. Collins, Gary C. Hart, R. T. Gabler, and Bruce Kennedy Feb. 1972 62 p refs
(Contract NAS8-27331)
(NASA-CR-123575) Avail: NTIS CSCL 20K

The results of research in applying statistical methods to the problem of structural dynamic system identification are presented. The study is in three parts: a review of previous approaches by other researchers, a development of various linear estimators which might find application, and the design and development of a computer program which uses a Bayesian estimator. The method is tried on two models and is successful where the predicted stiffness matrix is a proper model, e.g., a bending beam is represented by a bending model. Difficulties are encountered when the model concept varies. There is also evidence that nonlinearity must be handled properly to speed the convergence. Author

N72-20898*# Texas A&M Univ., College Station. Engineering Experiment Station.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE BEHAVIOR OF SEMI-INFINITE METAL TARGETS UNDER HYPERVELOCITY IMPACT
Basavaraju Chakrapani and James L. Rand Oct. 1971 150 p refs
(Contract NGR-44-001-106)
(NASA-CR-115439; TEES-9075-CR-71-02) Avail: NTIS CSCL 20K

The material strength and strain rate effects associated with the hypervelocity impact problem were considered. A yield criterion involving the second and third invariants of the stress deviator and a strain rate sensitive constitutive equation were developed. The part of total deformation which represents change in shape is attributable to the stress deviator. Constitutive equation is a means for analytically describing the mechanical response of a continuum under study. The accuracy of the yield criterion was verified utilizing the published two and three dimensional experimental data. The constants associated with the constitutive equation were determined from one dimensional quasistatic and dynamic experiments. Hypervelocity impact experiments were conducted on semi-infinite targets of 1100 aluminum, 6061 aluminum alloy, mild steel, and commercially pure lead using spherically shaped and normally incident pyrex projectiles. Author

N72-20899# Lockheed Missiles and Space Co., Palo Alto, Calif.
LARGE DEFORMATIONS AND CARRYING CAPACITY OF SHELLS INITIALLY OF CYLINDRICAL SHAPE
V. M. Trushina [1971] 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Mekh. Tverd. Tela (USSR), no. 5, 1971 p 193-199
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of equilibrium under large plastic deformations of a shell of initially cylindrical shape with stiff bottoms subjected to constant internal pressure is examined. The shell bending and compression stiffness is assumed to be zero and the usual assumptions of the theory of thin membrane shells are taken. A dependence of the nondimensional shell length referred to the diameter is established. Results referring to the question

of the possible post-critical state are obtained. An attempt is made to select the optimum shell construction in terms of equal strength of housing and bottom. Author

N72-20900# Lockheed Missiles and Space Co., Palo Alto, Calif.
NATURAL VIBRATIONS OF AN ELASTIC HOLLOW BALL IN A LIQUID OR GAS
T. P. Petrenko [1971] 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Mekh. (USSR), v. 24, no. 5, 1971 p 37-46
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The natural vibrations of a hollow ball in a liquid or gas are determined. The hollow ball is assumed to be elastic and isotropic. The vector spherical functions are used to solve the electrodynamic problems of a sphere. The natural vibrations of a hollow ball in a fluid are divided into three classes: (1) radial vibrations, (2) vibrations of the first class, and (3) vibrations of the second class. Mathematical models are presented to support the theoretical considerations. Author

N72-20901*# Computer Sciences Corp., Falls Church, Va.
NASTRAN BENEFITS ANALYSIS. VOLUME 1: EXECUTIVE SUMMARY
15 Feb. 1972 25 p
(Contract NAS5-11724)
(NASA-CR-125882) Avail: NTIS CSCL 20K

The acceptance of NASTRAN, the NASA structural analysis computer program, is explored, based on data from a sample set of users. Baseline data are generated for future comparison of costs and benefits of the program. The impact on, and benefits to, segments of government and industry from current use of NASTRAN are considered. Ways in which potential users may benefit from application of the program to their individual needs are also discussed. Author

N72-20902*# Computer Sciences Corp., Falls Church, Va.
NASTRAN BENEFITS ANALYSIS. VOLUME 2: FINAL TECHNICAL REPORT
15 Feb. 1972 248 p
(Contract NAS5-11724)
(NASA-CR-125883) Avail: NTIS CSCL 20K

Baseline data are considered for comparisons of the costs and benefits of the NASA structural analysis program and to determine impacts and benefits to current users. To develop this information, questionnaires were mailed to users. Personal and telephone interviews were made to solicit further information. The questions in the questionnaire and in the interview were related to benefits derived from the programs, areas of needed improvement, and applicable usage comments. The collected information was compiled and analyzed. Methodology, analyses, and results are presented. The information is applicable to issues preceding NASTRAN Level 15. Author

N72-20903# Purdue Univ., Lafayette, Ind. School of Aeronautics, Astronautics and Engineering Sciences.
NONLINEAR RESONANT VIBRATIONS OF INFINITELY LONG CYLINDRICAL SHELLS
Jerry H. Ginsberg 16 Mar. 1972 41 p refs Backup document for AIAA synoptic scheduled for publication in AIAA Journal in Aug. 1972
Avail: NTIS

Large amplitude, forced vibrations of infinitely long, thin cylindrical shells are determined, using generalized coordinates which are an infinite sequence of normal modes of linear shell theory. A perturbation procedure retains all the generalized coordinates necessary for the first approximation of nonlinearity. Many unusual responses are found to be possible, in which the nodal lines of the applied, spatially sinusoidal pressure and of the radial displacement do not agree. The results for the case of plane strain are found to be in agreement with solutions for rings previously obtained. Author

N72-20904# Technische Univ., Berlin (West Germany).
CONTRIBUTION TO THE THEORY OF THE ITERATION METHOD FOR THE NONLINEAR CALCULATION ON STATIC LOADED WINGS USING THE SHALLOW ARCH EXAMPLE [BEITRAG ZUR THEORIE DER ITERATIONSVERFAHREN FUER DIE NICHTLINEARE BERECHNUNG STATISCH BELASTETER TRAGWERKE AM BEISPIEL EBENER BOEGEN]
Carl-Hellmut Wagemann Sep. 1970 65 p refs In GERMAN
Avail: NTIS

Nonlinear calculations of statically loaded wings using an iteration method and its theoretical convergence are presented. Two different methods for solving the convergence relationship are shown. The first method requires the altering of the iterations variables with the load and leads to the result in which convergence is expected when the terms are handled according to Theory 2. In the second method, an artificial problem is introduced, which examines certain points lying on the load difference curves. If the relation of the previously given load to the lowest ideal buckling load of the artificial problem is less than one, the iteration converges. Mathematical models and graphs are included to support the theoretical considerations.
Transl. by P.N.F.

N72-20905*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TWO DEGREE INVERTED FLEXURE Patent Application
Wayne O. Hadland, inventor (to NASA) Filed 29 Oct. 1971 13 p
(NASA-Case-ARC-10345-1; US-Patent-Appl-SN-193671) Avail: NTIS CSCL 20K

A two-degree of freedom, inverted flexure is described which is useful for various purposes such as positioning magnetometers, lasers and telescopes and for mounting models in wind tunnels. The device has a number of advantages over prior art flexures. It is easily made from a single block of material by simple sawing and drilling operations; it has inherent built-in stops and the flexural axes can be shifted off the geometric center. Either one or both of the axes can be so shifted. The flexure is of the inverted configuration so that the two mechanical connections are easily made from one side of the device. NASA

N72-20906# Royal Aircraft Establishment, Farnborough (England).
ON THE SELECTION OF OPTIMUM MATERIALS FOR FATIGUE-LOADED STRUCTURES
W. Schutz Oct. 1971 28 p refs Transl. into ENGLISH from Z. fuer Werkstofftech. (West Germany), v. 2, no. 4, 1971 p 189-197
(RAE-Lib-Trans-1625; BR-28208) Avail: NTIS

An optimum material for fatigue loaded structures is considered one which makes it possible to build lightly but nevertheless safely and which requires no expensive inspection. It is possible to build a light structure if the fatigue strength of the material in component form is high for the mean stresses and ambient conditions involved, if this fatigue strength is subject to no more than slight scatter and if the material in the component can tolerate high tensile stresses without danger of stress corrosion. It is possible to build safely if a surface crack advances only slowly, if the residual static strength is high, and if no unacceptable changes in the static characteristics occur as the result of fatigue loads. Slow crack propagation and high residual strength, moreover, indicate low inspection expenditure. The advantages must be considered in relation to disadvantages in other respects. With the introduction of high strength materials, the notch and mean stress sensitivity almost always increases, the crack propagation properties become worse and the strength in the cracked state decreases. The successful application of modern high-strength materials requires high quality detail design, costly production and efficient inspection.
Author

N72-20907# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
BONDED STRUCTURES AND THE OPTIMUM DESIGN OF A JOINT
V. Niranjan Jul. 1971 26 p refs
(UTIAS-TN-164) Avail: NTIS

The importance of adhesive bonding in spacecraft structures is discussed with respect to application in: (1) the fabrication of heat shields for reentry vehicles, (2) solid propellant rocket motors, (3) Saturn structures, and (4) the solar panels on the Surveyor. Results of static and fatigue tests on double strap joints are presented. Two methods of designing such joints for static and fatigue loading are discussed. The first is a semi-empirical approach yielding approximate results. The second method is computer-oriented, making use of a polynomial representation of data and the theorem of Sturm (theory of equations) to determine the optimum length of overlap for the joint. Author

N72-20908# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
SEGPIPE: A PROGRAM TO DETERMINE THERMO-ELASTIC DEFORMATIONS IN A SEGMENT OF A HOLLOW CYLINDER
R. J. M. Crozier Sep. 1971 44 p refs
(AECL-4056) Avail: AEC Depository Libraries

The FORTRAN program SEGPIPE is designed to determine the thermo-elastic deformations which arise in a segment of a hollow circular cylinder. The inner and outer surfaces of the cylinder are subjected to temperature changes, normal stresses and shear stresses, all of which may vary around the circumference of the cylinder. The length of the cylinder may change. The preparation of input data has been made particularly simple and the central processor time required to execute a typical problem is of the order of 15 seconds. The problem of the nonuniform heating of a fuel sheath containing an eccentrically placed fuel pellet is used as an illustration. Author (NSA)

N72-20909# Sandia Labs., Albuquerque, N.Mex.
BENDING STRESSES PROPAGATING FROM THE CLAMPED SUPPORT OF A BEAM PRODUCED BY UNIFORM LATERAL PRESSURE PULSES
M. J. Sagartz and M. J. Forrestal Nov. 1971 18 p refs
(SC-RR-710795) Avail: NTIS

A clamped, semi-infinite, elastic beam is subjected to a uniform lateral impulse. Solutions to the Timoshenko and elementary beam equations for the bending stress propagating from a clamped support are derived. The Timoshenko solution is then used as an influence function to calculate the bending stress response for a sine-squared pressure pulse which can be generated in the laboratory. Author

N72-20910# National Aerospace Lab., Amsterdam (Netherlands).
RESIDUAL STRENGTH OF CRACKED STIFFENED PANELS
H. Vlieger Jan. 1971 30 p refs Submitted for publication
Sponsored by Neth. Aircraft Develop. Board
(NLR-TR-71004-U) Avail: NTIS

A method for the prediction of the residual strength of cracked stiffened panels, is futher evaluated. It takes full account of the sheet-stringer interaction and sets a criterion for unstable crack growth arrest. The results of residual strength tests on bonded and riveted panels with symmetric stiffeners or eccentric Z-stringers substantiate the residual strength hypothesis. Finally results of computed stress distributions and interacting rivet forces are presented. Author (ESRO)

N72-20911# Technische Hogeschool, Delft (Netherlands). Vliegtuigbouwkunde.
THE WINDING OF PRESSURE VESSELS ACCORDING TO THE 'NETTING' THEORY [HET WIKKELEN VAN DRUKVATEN VOLGENS DE 'NETTING' THEORIE]
T. de Jong Apr. 1971 28 p refs In DUTCH
(VTH-166) Avail: NTIS

The design of filament wound pressure vessels based on isotensoid loading of the fibers (netting theory), is described. The resin is a nonsupporting bonding material, and the fibers, wound according to geodetic lines, are loaded equally everywhere. The optimal shape of the pressure vessel and the winding pattern are determined by one single parameter, namely, the ratio between the largest and smallest diameters of the optimal part of the vessel. This parameter also indicates a simple relationship between over pressure and the necessary number of fibers. ESRO

N72-20912# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ELASTIC ANALYSIS OF CYLINDRICAL CONFIGURATIONS WITH STRESS SINGULARITIES
Adam R. Zak Sep. 1971 35 p refs
(RDT/E Proj. 1B6-21103-A-660)
(AD-733877; BRL-MR-2119) Avail: NTIS CSCL 20/11

The problem of stress analysis of a circular cylinder is considered under conditions which give rise to stress singularities. Such stress can be produced by circular boundary discontinuities or when boundaries are subject to mixed displacement and force conditions. General solutions are obtained using transformation of the cylindrical coordinates and these solutions converge in the singular region. The results predict exactly the singular behavior and the analysis generates solutions which can be used over a finite region of the cylinder. A numerical example is given showing the application of this analysis to a circular cylinder completely clamped at one end and loaded axially at the other. In this example the stresses and displacements from the present solution are matched with the corresponding quantities obtained from a finite element analysis. The matching is performed at a finite distance from the stress singularity. Good agreement is obtained between the two methods. Author (GRA)

N72-20913# Notre Dame Univ., Ind. Coll. of Engineering.
BUCKLING OF CLAMPED DEEP SPHERICAL SHELLS
N. C. Huang Nov. 1971 41 p refs
(Contract N00014-68-A-0152; NR Proj. 260-112; UND Proj. 99850; Proj. Themis)
(AD-734674; THEMIS-UND-71-4) Avail: NTIS CSCL 20/11

The paper deals with the buckling of clamped elastic deep spherical shells subject to a uniformly distributed external pressure. It is assumed that the prebuckling deformation of the shell is so small that the linear shell theory can be employed in the analysis. It is also assumed that the deflection pattern of the shell is shallow and the second order terms of the deflection slopes in the expression of potential energy can thus be neglected. Series solutions of the prebuckling axisymmetrical deformation are obtained. Based on the asymmetrical bifurcation with shallow buckling modes, buckling of the shell is then studied. The buckling load is expressed as a Rayleigh quotient and in turn solved by Rayleigh-Ritz method. Author (GRA)

N72-20914# Notre Dame Univ., Ind. Coll. of Engineering.
IMPULSIVE LOADING OF RECTANGULAR PLATES WITH FINITE PLASTIC DEFORMATIONS
B. Sureshwara, L. H. N. Lee, and T. Ariman Nov. 1971 50 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-734675; THEMIS-UND-71-5) Avail: NTIS CSCL 20/11

This paper is concerned with the responses of inelastic rectangular plates to impulsive loadings. The effects of strain hardening and strain rate sensitivity of the material are taken into consideration in this analysis. A variational principle in dynamics of inelastic bodies subject to finite deformation is used to determine the deformation process of the plate. A sandwich plate idealization is employed. The accuracy of the numerical solution is evaluated by comparing it with the existing analytical and experimental results. The results indicate that this method is adequate for determining the dynamic behavior of inelastic rectangular plates at relatively large deformations. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-20915* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHELL SIDE LIQUID METAL BOILER Patent
Gerald M. Kikin, Maurice L. Peelgren, Wayne M. Phillips, and Jerry P. Davis, inventors (to NASA) Issued 28 Dec. 1971 22 p Filed 10 Feb. 1970 Supersedes N70-25929 (08 - 12, p 2215 Sponsored by NASA
(NASA-Case-NPO-10831; US-Patent-3,630,276; US-Patent-Appl-SN-10161; US-Patent-Class-165-158; US-Patent-Class-122-32; US-Patent-Class-165-161; US-Patent-Class-165-174; US-Patent-Class-165-133; US-Patent-Class-165-155) Avail: US Patent Office CSCL 20M

A shell-side liquid metal boiler including a tube and shell heat exchanger is described which is particularly suited for use in effecting a heat exchange between continuously flowing primary and secondary fluids within a two-loop Rankine cycle power system. The boiler is characterized by a number of tubular conduits through which there is delivered a heated primary fluid, and a boiler chamber within which shell-side boiling of the secondary fluid is achieved. A number of mutually spaced, angularly related baffle plates are mounted within the boiler and provide a tortuous path having both crossflow and spiral-flow path components, whereby the secondary fluid is permitted to circulate about the surfaces of the tubular conduits for achieving a heat exchange through shell-side boiling of the liquid metal within the boiler chamber.

Official Gazette of the U.S. Patent Office

N72-20916*# Aerojet Liquid Rocket Co., Sacramento, Calif.
INVESTIGATION OF GH2-GO2 COMBUSTION Quarterly Report for period ending 26 Dec. 1971
D. F. Calhoon 15 Jan. 1972 100 p
(Contract NAS3-14379)
(NASA-CR-125886; QR-2) Avail: NTIS CSCL 21B

Data from prototype GO2-GH2 injection elements were obtained and analyzed. The bulk of the testing was conducted with nonreacting propellants, N2 to simulate the O2 and H2. A limited number of tests were conducted in combusting environment, with the purpose of this testing being to evaluate the effects of combustion on cold flow mixture ratio and mass profiles. The cold flow testing was completed in 223 tests. Analytical model correlations of these data are under way. The hot flow testing was completed in 36 tests. These data have been reduced and are documented in the report. Author

N72-20917# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON NECESSARY CONDITIONS FOR A STEP CHANGE IN THE VELOCITY OF COMBUSTION OF CONDENSED SYSTEMS
I. G. Assovskii, A. G. Istratov, and V. B. Librovich [1971] 8 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz. (USSR), no. 6, 1971 p 57-64
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the theory of combustion based on the effects of pressure, light flux, velocity of erosive gas flux, and velocity of combustion is presented. The solution of the problem is accomplished by finding sufficient conditions to realize a given change in the velocity of combustion. Besides the direct problem, attention is also given to the inverse problem of a given law of time variation of the velocity of combustion. Mathematical models are presented to support the theoretical considerations. Author

N72-20918# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE THEORY OF NONSTATIONARY POWDER COMBUSTION. STABILITY OF THE PROCESSES IN A SEMI-INFINITE VOLUME
Iu. A. Gostintsev, L. A. Sukhanov, and P. F. Pokhill [1971] 10 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz. (USSR), no. 6, 1971 p 65-73
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Equations describing the processes during powder combustion in a semi-infinite volume are obtained on the basis of a phenomenological theory of nonstationary combustion. A solution is found for these equations for small changes in the nozzle critical section. The stability of the processes within the chamber is investigated. Author

N72-20919*# North American Rockwell Corp., Downey, Calif. Space Div.
STUDY OF LOW-COST FABRICATION OF ABLATIVE HEAT SHIELDS Final Report, May 1971 - Mar. 1972
L. B. Norwood 31 Mar. 1972 146 p refs
(Contract NAS1-10708)
(NASA-CR-112036; SD-72-SH-0005) Avail: NTIS CSCL 22B

The major objectives were accomplished in three tasks: (1) modification of the ablative material composition for ease of fabrication as well as thermal and mechanical performance; (2) scaled-up, simplified, manufacturing techniques which resulted in cost reductions; and (3) the identification of a significant design problem caused by the differential pressure buildup imposed on mechanically attached ablative heat shield panels during launch. Author

N72-20920*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
FAULT DETERMINATIONS IN ELECTROEXPLOSIVE DEVICES BY NONDESTRUCTIVE TECHNIQUES
Vincent J. Menichelli and Louis A. Rosenthal 15 Mar. 1972 18 p refs
(Contract NAS7-100)
(NASA-CR-125858; JPL-TR-32-1553) Avail: NTIS CSCL 19A

Several nondestructive test techniques were developed for electroexplosive devices. The bridgewire responds, when pulsed with a safe level current, by generating a characteristic heating curve. The response is indicative of the electrothermal behavior of the bridgewire-explosive interface. Bridgewires which deviate from the characteristic heating curve were dissected and examined to determine the cause of the abnormality. Deliberate faults were fabricated into squibs. The relationship of the specific abnormality and the fault associated with it is demonstrated. Author

N72-20921# Technische Univ., Berlin (West Germany). Fachbereich fuer Verfahrenstechnik.
THE HEAT TRANSFER TO BOILING HELIUM 1 IN FORCED VERTICAL PIPE FLOW Ph.D. Thesis [DER WAERMEUEBERGANG AN SIEDENDES HELIUM I BEI ERZWUNGENER STROEMUNG IM SENKRECHTEN ROHR]
Gerd Hildebrandt 1971 88 p refs In GERMAN
Avail: NTIS

The heat transfer of boiling helium by forced flow in vertical pipes (inner diameter one millimeter, length twenty millimeters) is discussed. The mass stream density varied between 0.56 and 7.63 grams per square centimeter. The Reynolds number associated with the condition of the helium stream at the entrance of the measuring section was between 1730 and 23,600, indicating a predominately turbulent condition. In agreement with previous research on helium and heat transfer in fluids the dependence on mass stream density is confirmed.

Transl. by P.N.F.

N72-20922# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
FILM-COOLING EFFECTIVENESS IN THE THREE DIMEN-

SIONAL FLOW REGION DOWNSTREAM OF A SQUARE HOLE

S. V. Patankar and D. B. Spalding Dec. 1971 13 p refs
(EFF/TN/A/44) Avail: NTIS

Calculations are described which were made using a procedure for three-dimensional recirculating flow. The velocity and temperature fields were calculated for the situation in which an adiabatic plate in a hot uniform stream is cooled by a jet issuing from a square hole. Calculations are presented for two cases: in the first, the jet velocity is larger than the main stream velocity; in the second, the jet velocity is much smaller than that of the main stream. The second case, which is akin to flow over an obstacle, gives rise to recirculation in the main stream direction. The flow is taken as laminar and the fluid properties as uniform. Author

N72-20923*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF NORMAL ACCELERATION ON TRANSIENT BURNING RATE AUGMENTATION OF AN ALUMINIZED SOLID PROPELLANT

G. Burton Northam Washington Apr. 1972 58 p refs
(NASA-TN-D-6625; L-7847) Avail: NTIS CSCL 21B

Instantaneous burning rate data for a polybutadiene acrylic acid propellant, containing 16 weight percent aluminum, were calculated from the pressure histories of a test motor with 96.77 sq cm of burning area and a 5.08-cm-thick propellant web. Additional acceleration tests were conducted with reduced propellant web thicknesses of 3.81, 2.54, and 1.27 cm. The metallic residue collected from the various web thickness tests was characterized by weight and shape and correlated with the instantaneous burning rate measurements. Rapid depressurization extinction tests were conducted in order that surface pitting characteristics due to localized increased burning rate could be correlated with the residue analysis and the instantaneous burning rate data. The acceleration-induced burning rate augmentation was strongly dependent on propellant distance burned, or burning time, and thus was transient in nature. The results from the extinction tests and the residue analyses indicate that the transient rate augmentation was highly dependent on local enhancement of the combustion zone heat feedback to the surface by the growth of molten residue particles on or just above the burning surface. The size, shape, and number density of molten residue particles, rather than the total residue weight, determined the acceleration-induced burning rate augmentation. Author

N72-20924*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ENGINE INVESTIGATION OF AN AIR-COOLED TURBINE ROTOR BLADE INCORPORATING IMPINGEMENT-COOLED LEADING EDGE, CHORDWISE PASSAGES, AND A SLOTTED TRAILING EDGE

Robert P. Dengler, Frederick C. Yeh, James W. Gauntner, and Gerald E. Fallon Washington Apr. 1972 45 p refs
(NASA-TM-X-2526; E-6450) Avail: NTIS CSCL 28E

Experimental temperatures are presented for an air-cooled turbine rotor blade tested in an engine. The data were obtained for turbine stator inlet temperatures from 2000 to 2500 F and for turbine-inlet gas pressures from 32 to 46 psia. Average and local blade heat-transfer data are correlated. Potential allowable increases in gas temperature are also discussed. Author

N72-20925# Royal Aircraft Establishment, Farnborough (England).

THE PURE AND APPLIED CHEMISTRY OF COMBUSTION

Gosta Lindner Dec. 1971 16 p Transl. into ENGLISH from Swedish report FOA-1-A1484-92
(RAE-Lib-Trans-1631; FOA-1-A-1484-92; BR-28412) Avail: NTIS

The initiation of fires, spreading of fires, and methods for extinguishing fires are described. The characteristics of conventional incendiary weapons are presented. Pure and applied chemical aspects of fire in different contexts, with special reference to the concepts of duration and quantity of heat are examined. Adequate fire research can only be conducted when supplemented by aspects of physical chemistry, applied chemistry, and model testing. Author

N72-20926# Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.

INTERNAL LAMINAR FLOW AND HEAT TRANSFER WITH WALL MASS TRANSFER

G. D. Raithby Mar. 1972 97 p refs
(RR-20) Avail: NTIS

Developed velocity profiles, for flows with mass addition or withdrawal through the boundary, are reported for both circular tube and two-dimensional rectangular duct geometries. For flow in a two dimensional duct, a new solution was found, which suggests the possibility of a transition to turbulence induced by suction. Equations representing the friction coefficients are presented for both geometries. The development of the temperature field, in a region of fully developed velocity, was analyzed for both ducts and for constant temperature and constant heat flux boundary conditions. The nearly universal dependence of the heat transfer results on a single parameter, namely, a Peclet number based on the velocity of the fluid crossing the wall, was demonstrated. Several asymptotic solutions to the energy equation were obtained for high rates of mass addition and withdrawal. Temperature profiles, the axial development of the centerline, bulk and wall temperatures, as well as Nusselt numbers in the thermal entrance and thermally developed regions are illustrated graphically. Author

N72-20927# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE QUESTION OF THE STABILITY OF POWDER COMBUSTION IN A SEMI-INFINITE VOLUME

V. N. Viliunov and A. P. Rudnev 18 May 1971 6 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 6 1971 p 74-79
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The influence of perturbations in the gas temperature on the stability of powder combustion in a rocket chamber was investigated theoretically. It was determined that the stationary combustion velocity in the adiabatic mode depends only on the pressure and initial temperature of the powder. In real cases of combustion, the heat elimination from the flame zone results in a reduction of the maximum temperature as against the adiabatic combustion temperature, which will result in a reduction in the combustion velocity and the presence of propagation limits. Author

N72-20928*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SHUTTLE REENTRY AERODYNAMIC HEATING TEST Interim Report, 1971

J. E. Pond, P. O. McCormick, and S. D. Smith Dec. 1971 83 p refs
(Contract NAS8-26359)
(NASA-CR-123580; HREC-6359-1; LMSC/HREC-D225535) Avail: NTIS CSCL 20M

The research for determining the space shuttle aerothermal environment is reported. Brief summaries of the low Reynolds number windward side heating test, and the base and leeward heating and high Reynolds number heating test are included. Also discussed are streamline divergence and the resulting effect on aerodynamic heating, and a thermal analyzer program that is used in the Thermal Environment Optimization Program. F.O.S.

N72-20929# Oak Ridge National Lab., Tenn.

TUBE IDENTIFIER: A PHYSICAL DESCRIPTION OF TUBES TESTED IN THE OSW PROGRAM ON IMPROVED HEAT TRANSFER SYSTEM FOR EVAPORATORS: ADVANCED LTV HEAT TRANSFER SURFACES

H. W. Hoffman and L. G. Alexander Oct. 1971 36 p Revised (Contract W-7405-eng-26; Di-40-224-70; OSW-14-30-2535) (ORNL-TM-2713-Rev-1) Avail: NTIS

A physical description is given of the evaporator-condenser tubes examined at the Oak Ridge National Laboratory under the program on advanced LTV heat transfer surfaces. Author

N72-20930# Aerotherm Corp., Mountain View, Calif.
HEAT TRANSFER AND ABLATION RATE CORRELATIONS FOR ENTRY HEAT SHIELD AND NOSETIP APPLICATIONS
Eugene P. Bartlett and Kurt E. Putz (Sandia Labs., Albuquerque) [1971] 11 p Supported by AEC (SC-DC-714278) Avail: NTIS

The transfer coefficients are based on solutions of the chemically-reacting boundary layer over graphite and various charring ablation materials. For the most part, surface temperature and the ratio of the pyrolysis gas rate to the surface recession rate are treated as input parameters. The surface is considered to be in equilibrium with the gases adjacent to the surface; thus, char recession rates are obtained during the course of the calculation. The evaluation of the chemical state is fully coupled with the governing conservation equations with nominally 60 species given consideration. Diffusion coefficients are considered equal for all species, and viscosity and conductivity are calculated using conventional mixture relations. D.L.G.

N72-20931# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SOME EXAMPLES OF HEAT TRANSFER IN NONBOILING TWO-PHASE SYSTEM
Jean-Marc Delhaye Sep. 1971 47 p refs In FRENCH (CEA-N-1452) Avail: AEC Depository Libraries

The most recent results concerning dropwise condensation, thermal energy storage, ablation, dispersed flows and direct contact exchangers are reviewed. Applications of such methods cover many subjects such as nuclear engineering, disalination, oceanography, space exploration, medicine and chemical engineering. NSA

N72-20932# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
CALCULATION OF HEAT REMOVAL THROUGH NATURAL CONVECTION IN THE STATIONARY REGION OF GAS-COOLED REACTORS WITH THE HELP OF THE COMPUTER PROGRAM NAKOSTA
J. Singh and K. U. Schneider Jun. 1971 75 p refs In GERMAN (JUL-770-RG) Avail: AEC Depository Libraries

A computer program NAKOSTA (Natural Convection in the Stationary Condition) was made to calculate the heat transport by natural convection with a given course of surface temperature along a defined, closed circuit. This circuit consists of a heat-supplying and a heat-removing component. These two main components are divided into some axial zones in order to determine the local coolant temperatures with a given mass flow under consideration of the corresponding heat transfer coefficient or overall heat transfer coefficient. At the same time, the local coefficients of pressure loss and the local factors of pressure loss are calculated. An iteration procedure determines buoyancy and pressure loss along the circuit with the corresponding mass flow, and the removable heat amount per unit time. Some examples show different cooling arrangements and gases (helium, air, CO2) and their ability to remove heat at various system pressures. Author (NSA)

N72-20933# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
SAFETY TEST ON A HEAT PUMP DEVICE
J. Perrin and J. F. Veyrat 7 Jun. 1971 5 p In FRENCH Presented at Conf. on Radiation Devices, Cadarache, France (CEA-CONF-1841; PI(NT)-472-129/71; CONF-710628-2) Avail: AEC Depository Libraries

A safety study of the lower part of a thermopump irradiation device was made. A test was performed to analyze the damages undergone by the device and the reactor when the ruptures of both a sodium pipe and a cooling water pipe occur simultaneously. The accident had no consequential effect on the reactor operation and control. NSA

N72-20857*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL AND THEORETICAL AERODYNAMIC HEATING AND FLOW FIELD ANALYSIS OF A SPACE SHUTTLE ORBITER
R. K. Matthews, T. D. Buchanan, W. R. Martindale, and J. D. Warmbrod *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 261-296 refs Prepared in cooperation with Aro, Inc. (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20858*# Grumman Aerospace Corp., Bethpage, N.Y.
A REVIEW OF THE GRUMMAN ORBITER WIND TUNNEL HEAT TRANSFER TESTS
A. R. Mendelsohn, M. Bourbin, M. Jew, and C. W. Osonitsch *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 297-345 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20859*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH REYNOLDS NUMBER TURBULENT HEATING TO TWO SIMPLIFIED SHUTTLE CONFIGURATIONS
Charles B. Johnson *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 347-373 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20860*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF ROUGHNESS ON HEATING AND BOUNDARY-LAYER TRANSITION. PART 1: EFFECTS OF SIMULATED PANEL JOINTS ON BOUNDARY-LAYER TRANSITION
H. lee Seegmiller *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 375-394 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20861*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF ROUGHNESS ON HEATING AND BOUNDARY-LAYER TRANSITION. PART 2: EFFECTS OF DISCRETE ROUGHNESS ON HEATING
George G. Mateer *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 395-411 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20862*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LEE-SIDE FLOW PHENOMENA ON SPACE SHUTTLE CONFIGURATIONS AT HYPERSONIC SPEEDS. PART 1: FLOW SEPARATION AND FLOW FIELD VISCOUS PHENOMENA OF A DELTA-WING SHUTTLE ORBITER CONFIGURATION
J. W. Cleary *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 413-449 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20863*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LEE-SIDE FLOW PHENOMENA ON SPACE SHUTTLE CONFIGURATIONS AT HYPERSONIC SPEEDS. PART 2: STUDIES OF LEE-SURFACE HEATING AT HYPERSONIC MACH NUMBERS
Jerry N. Hefner and Allen H. Whitehead, Jr. *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 451-467 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20864*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AEROTHERMODYNAMIC MEASUREMENTS FOR SPACE SHUTTLE CONFIGURATION IN HYPERSONIC WIND TUNNELS
John J. Bertin (Texas Univ., Austin), Frank E. Williams (Texas Univ., Austin), Robert C. Baker (Texas Univ., Austin), Winston D. Goodrich, and William C. Kessler (McDonnel-Douglas Astonaut. Corp., St. Louis) *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 469-501 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20865*# North American Rockwell Corp., Downey, Calif. Space Div.
DETERMINATION OF AEROTHERMODYNAMIC ENVIRONMENT UNCERTAINTIES WITH APPLICATION TO SPACE SHUTTLE VEHICLES
C. A. Scottoline *In* NASA. Langley Res. Center Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 503-518 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20867*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ANALYSIS OF THE BOOSTER PLUME IMPINGEMENT ENVIRONMENT DURING THE SPACE SHUTTLE NOMINAL STAGING MANEUVER
C. J. Wojciechowski (Lockheed Missiles and Space Co., Inc., Huntsville, Ala.), M. M. Penny (Lockheed Missiles and Space Co., Inc., Huntsville, Ala.), T. F. Greenwood, and I. H. Fossler *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 607-644 refs (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

N72-20869*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HEAT-TRANSFER TESTING PROCEDURES IN PHASE B SHUTTLE STUDIES WITH EMPHASIS ON PHASE CHANGE DATA IMPROVEMENT
David A. Throckmorton *In its* Space Shuttle Aerothermodyn. Technol. Conf., vol. 2 Feb. 1972 p 661-682 (See N72-20856 11-31)
Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-20934 Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Electrique.
ELABORATION OF A CONCEPTUAL THESAURUS [ELABORATION D'UN THESAURUS DE CONCEPT]
Emile Peeters Dec. 1971 60 p refs In FRENCH Sponsored by IRSIA
(CRIF-EL-3) Copyright. Avail: Issuing Activity
A thesaurus on automation and process control has been designed by the Belgian Scientific and Technical Research Center of the Metal Manufacturers Association. The thesaurus and the growth law as functions of the number of processed documents is discussed. This law is found to be consistent with one derived for the chemical literature. Organigrams for input data check, alphabetical ordering in three different languages, and hierarchical or cross referencing of terms are shown. Semantic relations between terms are discussed. ESRO

N72-20935*# Indiana Univ. Foundation, Bloomington.
STATISTICAL AND OPERATIONAL SUMMARIES Final Annual Report
Joseph DiSalvo 15 Jan. 1972 27 p
(Contract NASW-2171)
(NASA-CR-125888; AR-1) Avail: NTIS CSCL 05A
Statistical progress indicator forms are presented on the financial management of the research allocations. Promotional activities, conference participants, and services are tabulated. The staffing and activity levels are also discussed, as well as the fee schedule revision and the standard interest profile offerings. J.A.M.

N72-20936# Committee on Science and Astronautics (U. S. House).
ACQUISITION OF CAPITAL PLANT - NASA
Washington GPO Feb. 1972 57 p refs Presented to the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 28 Feb. 1972
Avail: Subcomm. on NASA Oversight
A report compiled from testimony concerning the inquiry into NASA's policies and procedures regarding the acquisition of capital plant is presented. Field level staff reviews revealed that much of the capital plant expansion was derived from funds for programs which did not reflect specific plant acquisition items. Irregularities at the Marshall Space Flight Center reported by the General Accounting Office are included. Some of the conclusions reached are: (1) NASA has not kept the committee fully and currently informed with regard to the acquisition of major facilities and equipment. (2) The annual authorization requests do not adequately identify and define the extent to which authorized funds will be used to acquire major items of a capital plant nature. (3) The use of research and development funds for new construction and rehabilitation and modifications at NASA field centers has been widespread. Recommendations for clarifying congressional intent with regard to the acquisition of the facilities and equipment are included. F.O.S.

N72-20937# Committee on Science and Astronautics (U. S. House).
AUTHORIZATION FOR FIRE RESEARCH AND SAFETY AND THE STANDARD REFERENCE DATA ACTS (H.R. 13034)
Washington GPO 1972 34 p refs Hearing before the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 17 Feb. 1972
Avail: Subcomm. on Sci., Res., and Develop.
The testimony concerning the authorization for fire research and safety, and the Standard Reference Data Acts is reported. Data presented include the NBS Report on Ignition Sources in Accident Cases Involving Flammable Fabrics. F.O.S.

N72-20938# Radio and Space Research Station, Slough (England).
CATALOGUE OF REPORTS AND REPRINTS IN WORLD DATA CENTRE C ROCKETS AND SATELLITES
1971 10 p refs
(Issue-2) Avail: NTIS
Data covering space research, satellite and rocket probes, satellite applications, radiation studies, interplanetary physics, and data recovery or processing are cataloged. E.H.W.

N72-20939# Advisory Group for Aerospace Research and Development, Paris (France).
THE 1971 AGARD ANNUAL MEETING
1971 76 p Meeting held at Nord-torpa, Norway, 8 Sep. 1971
Avail: NTIS

The themes of the 1971 AGARD conference were Norwegian industrial and defense research development and status and trends in international aerospace cooperation. The presentations of the speakers from various member nations are given, including a round table discussion on international cooperation. J.A.M.

N72-20940# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: MEETINGS, PUBLICATIONS, MEMBERSHIP, JANUARY 1972
Jan. 1972 64 p
(AGARD-Bull-72/1) Avail: NTIS

Summaries of the 1972 AGARD technical conferences are presented for the following panels: aerospace medical, avionics, electromagnetic wave propagation, flight mechanics, fluid dynamics, guidance and control, propulsion and energetics, and technical information. Abstracts of publications released in 1971, and an AGARD membership list are included. F.O.S.

N72-20941# National Aeronautics and Space Council, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1971 ACTIVITIES
Mar. 1972 130 p
Avail: SOD $1.25

Activity in the U.S. space program is reviewed with respect to the objectives of continued exploration of the moon; exploration of the planets and the universe; substantial reductions in the cost of space operations; extension of man's capability to live and work in space; expansion of the practical applications of space technology; and greater international cooperation. The accomplishments of NASA are described, emphasizing manned space flight and unmanned flights for obtaining space science data; advanced research and technology, tracking and data acquisition, and international and interagency affairs are covered. The space, aeronautics, and ground support activities of the Department of Defense are discussed, along with the Department of Commerce activities that contribute directly to the national aeronautics and space programs. The research and contributions of the other agencies and organizations are also mentioned.
N.E.N.

N72-20942*# National Aeronautics and Space Administration, Washington, D.C.
LEGAL ASPECTS OF THE UTILIZATION OF ARTIFICIAL SATELLITES FOR METEOROLOGICAL AND RADIO COMMUNICATION PURPOSES
G. P. Zhukov, E. G. Vasilevskaya, and P. I. Lukin Mar. 1972 156 p refs Transl. into ENGLISH of the book "Pravovyye Aspekty Ispolzovaniya Iskusstvennykh Sputnikov dlya Tseley Meteorologii i Radiosvyazi" Moscow, Nauka Press, 1970
(NASA-TT-F-669) Avail: NTIS CSCL 05D

Some of the basic international legal problems arising in the present and future use of meteorological and communications satellites are surveyed. Among the topics discussed are existing and proposed international legislation on the use of space for peaceful purposes, international legal control (administration) of national ground and space operations, liability for damage in space or resulting from space operations, and the legal status of private, international and intergovernmental organizations and their personnel. Much of the material is devoted to the 1967 Treaty on Space and the 1968 Agreement on the Recovery of Cosmonauts, along with various resolutions and other legislative items of the United Nations General Assembly. Particular attention is also given the comparison of the Soviet and American communications systems, Intersputnik and Intelsat, respectively. Author

N72-20943# Royal Aircraft Establishment, Farnborough (England).
SWEDISH DEFENCE RESEARCH ABSTRACTS, ISSUE 70/71-3
Oct. 1971 36 p Transl. into ENGLISH From Froe Foesvars Forsknings Referat, Oeppen Del 70/71-3
(RAE-Lib-Trans-1612) Avail: NTIS

Swedish abstracts covering Systems Analysis, Nuclear Reactions, Chemical and Biological Warfare, Conventional Warfare, Applied Physics, Electronics, and Biotechnology are presented. Other investigations include Military Psychology and Psychological Warfare. Author

N72-20944*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROPRIETARY SOFTWARE
Marvin J. Marnock Oct. 1971 16 p
(NASA-TM-X-67660) Avail: NTIS CSCL 05A

The protection of intellectual property by a patent, a copyright, or trade secrets is reviewed. The present and future use of computers and software are discussed, along with the governmental uses of software. The popularity of contractual agreements for sale or lease of computer programs and software services is also summarized. J.A.M.

N72-20945# RAND Corp., Santa Monica, Calif.
BUDGETS IN A DECENTRALIZED ORGANIZATION WITH INCOMPLETE INFORMATION
Martin Shubik Dec. 1970 25 p refs
(P-4514) Avail: NTIS

The problem of incentives in a decentralized organization where there is lack of information is discussed. It stresses the difficulty of designing incentive systems and provides a simple example to illustrate some of the problems. The treatment of the central agency and the decentralized departments is an n-person game. Author

N72-20946# RAND Corp., Santa Monica, Calif.
MAKING EVALUATION EFFECTIVE: A GUIDE
R. A. Levine and A. P. Williams, Jr. May 1971 47 p
(Contract C-MU-HEW5-70-155)
(R-788-HEW/CMU) Avail: NTIS

This is a guide to assist evaluators in the development of a strategy in determining: when to evaluate, who should evaluate and supervise the evaluation, how to allocate efforts among different types of evaluation, and assessing evaluation. The four objectives of the guide are to aid in: (1) the planning of evalution and related activities so limited resources are put where most needed; (2) carrying out evaluations in ways that are most likely to help in the making of decisions; (3) assessing and improving the total evaluation effort; and (4) using evaluation as a part of the policy making process. Author

N72-20947# RAND Corp., Santa Monica, Calif.
A STRATEGY FOR DEVELOPING IN STATE GOVERNMENT THE CAPABILITY TO CHANGE THROUGH SCIENCE AND TECHNOLOGY
Daniel J. Alesch Jun. 1971 35 p refs
(Grant NSF GI-44)
(R-785-NSF) Avail: NTIS

Recommended guidelines for developing state policies and programs in science and technology for the Office of Intergovernmental Science Programs are presented. Technology is defined as the application of scientific knowledge to the solution of social or economic problems. The requirements for state government innovation to meet the challenge of technological change are discussed including career patterns, role perceptions, resource allocation processes, and reward structures. It is concluded that major reshaping of state governments is required if the states are to be able to cope with social problems. F.O.S.

N72-20948# RAND Corp., Santa Monica, Calif.
SIGNED DIGRAPHS AND THE GROWING DEMAND FOR ENERGY
Fred S. Roberts May 1971 52 p refs
(Grant NSF GI-44)
(R-756-NSF) Avail: NTIS

An outline is given of a methodology which exploits the signed digraph for handling problems of forecasting energy demand and the effect of new technologies and institutions on that demand, and for generating and analyzing policy alternatives for meeting environmental constraints on energy use. The forecasting and policy problems are translated into signed digraph problems, and in particular to problems of so-called pulse processes on signed digraphs. Research problems related to the development of the methodology are described. Author

N72-20949# RAND Corp., Santa Monica, Calif.
CHANGE AND THE MANAGEMENT OF CHANGE
E. P. Durbin May 1971 11 p refs Presented at Human Resource Allocation Symp., Los Angeles, 15 Apr. 1971
(P-4652) Avail: NTIS

The failure of industries and government to account for institutional characteristics and their effect on policy process, policy initiation, choices between policies, and implementation of policy is examined. It is stated that planners and managers do not account adequately for organizational characteristics, they resist change, they do not learn, and they adapt very slowly. In the 70's the accelerating change from technology towards humanism will cause problems with increased government involvement and demands on the private sector. Management systems will have to deal with complex and unmeasurable social values and issues. J.A.M.

N72-20950# RAND Corp., Santa Monica, Calif.
PEARL: AN AUTOMATED PERIODICALS CONTROL SYSTEM
Cecily J. Surace Apr. 1971 37 p refs
(P-4627) Avail: NTIS

The PEARL system which is an automated periodicals control system which provides for automatic check-in and routing of periodicals is described. Instead of using claims cards or lists. the program produces double-column pressure sensitive labels combining check-in and routing in one operation. Negative reporting of nonreceived items is the basis for automatic update of holdings, rather than positive reporting. Other features are discussed, e.g., automated production of purchase order letters, claims and scrap lists, cross references and notes, etc. PEARL operates on the 360/65 and controls over 2000 active periodical titles, 3000 copies, and 680 inactive titles. Author

N72-20951# RAND Corp., Santa Monica, Calif.
POLICYMAKING AND TECHNOLOGY TRANSFER: THE NEED FOR NATIONAL THINKING LABORATORIES
Samuel N. Bar-Zakay Dec. 1970 24 p refs Submitted for publication
(P-4497) Avail: NTIS

The achievement and operational mechanism for improving policy making and technology transfer are discussed. Inter-context information is defined; the differences between incidental and organized technology transfer are specified. National thinking laboratories are proposed to promote organized technology transfer and act as a catalyst to organized policy making. J.A.M.

N72-20952# RAND Corp., Santa Monica, Calif.
SIMULATION OF WEATHER-SENSITIVE MILITARY OPERATIONS
Ralph E. Huschke Apr. 1971 17 p ref Presented at 1970 Meteorol. Tech. Exchange Conf., Annapolis, Md., 21-24 Sep. 1970
(P-4487) Avail: NTIS

Based on, and illustrated by, experience in designing a computer model of a weather-sensitive STRICOM operation, a set of guidelines is suggested for building simulation models of military operations for the purpose of quantifying the value of weather services. Results from the STRICOM model are presented as an argument supporting the desirability for the weather services to engage in this kind of analysis. Author

N72-20953# RAND Corp., Santa Monica, Calif.
THE MECHANICS OF FORECASTING THE COMMUNITY NOISE IMPACT OF A TRANSPORTATION SYSTEM
J. R. Gebman Nov. 1971 20 p refs
(P-4735) Avail: NTIS

A system analysis methodology, using computer programs and Robinson's noise pollution level contours, is described for assessing noise and environment pollution of modern transportation systems. Special attention is given to noise pollution and noise annoyance levels in communities. E.H.W.

N72-20954# RAND Corp., Santa Monica, Calif.
AN AGENDA FOR MANAGEMENT ANALYSIS
D. J. Alesch Sep. 1971 6 p refs Presented at 7th Management Analysis Conf., Hershey, Pa., 5 Nov. 1970
(P-4706) Avail: NTIS

Management analysis for governmental agencies is discussed. A four point agenda for management analysts is proposed which includes: (1) Analysts must reexamine organizational behavior, organizational change, and socio-technical systems in the light of new developments. (2) Analysts must view government as a complex set of systems steering an even more complex set of systems. (3) Analysts must focus on quantity and quality of the output of an agency as it relates to community problems. (4) Analysts must develop an expanded repertoire of analytical techniques. F.O.S.

N72-20955# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
A SURVEY OF THEORETICAL ANTENNA LITERATURE FOR THE YEAR 1970
F. Schlude Oct. 1971 38 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-71-28) Avail: NTIS; DFVLR Porz-Wahn: 12,10 DM

The theoretical antenna literature in the DFVLR-Institut fuer Flugfunk und Mikrowellen is compiled. The papers are first divided according to the theoretical methods used. For better understanding these methods are described in brief. Further, subdivision into applications is made. The German papers included in this survey are compiled separately and compared with another survey of papers for the years 1963 to 1966.
Author

N72-20956# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
COMMUNITY NOISE: SOURCES AND DIFFERENT SOCIETY-DEVELOPMENT IMPLICATIONS
L. X. Nepomuceno Nov. 1971 40 p refs In Portugese; ENGLISH summary Presented at 1st Brasilian Noise Pollution Symp., Rio de Janeiro, 21-27 Nov. 1971
Avail: NTIS

A study of annoying urban noise sources is presented. The sources are identified as traffic, industrial, aviation, and domestic. The need for unified legislation covering all noise sources, and based on actual measurements is discussed. Author

N72-20957*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPLANETARY FLIGHT AND COMMUNICATION. VOLUME 3, NO. 7: K. E. TSIOLKOVSKII, LIFE, WRITINGS, AND ROCKETS
Nikolai Alekseevich Rynin 1971 114 p refs Transl. into ENGLISH of "Mezhplanetnye Soobshcheniya. Tom 3, vypusk 7: K. E. Tsiolkovskii, Ego Zhizn, Raboty i Rakety" Leningrad, 1931 Sponsored by NASA and NSF

(NASA-TT-F-646; TT-70-50117; IPST-5818) Avail: NTIS CSCL 05D

The biography of the Russian scientist and inventor, K.E. Tsiolkovskii, is presented. Tsiolkovskii's principle works, rockets and projected flight, and his theory of rocket flight are surveyed. His ideas on gun ballistics, rocket motion in a vacuum, interplanetary flight, solar gravity, space flight feeding, and rocket launching are also reviewed. J.A.M.

N72-20958# Committee on Science and Astronautics (U. S. House).
PANEL ON SCIENCE AND TECHNOLOGY THIRTEENTH MEETING: REMOTE SENSING OF EARTH RESOURCES
Washington GPO 1970 412 p refs Proc. before the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., no. 13, 25-27 Jan. 1972
Avail: Comm. on Sci. and Astronaut.

Testimony given before the Committee on Science and Astronautics on the current state of the technology applicable to the research and development phase of remote sensing systems for earth resources is presented. Presentations covered: projections of additional requirements needed as these systems approach operational; identification of potential users of various data to be produced by the systems; organizational framework needed to establish effective operational systems; international implications of remote sensing systems; and problems of data handling and dissemination. A.L.

N72-20959*# Techtran Corp., Glen Burnie, Md.
SACI PROJECT PROGRESS REVIEW MEETING
Washington NASA Apr. 1972 132 p refs Transl. into ENGLISH of "Projeto SACI; Reuniao de Exame de Progresso", Rept. LAFE-174 Conselho Natl. de Pesquisas-Inst. de Pesquisas Espaciais, Sao Jose dos Campos, Brazil, Nov. 1971 141 p Conf. held at Sao Jose de Campos, Brazil, 25-26 Nov. 1971
(Contract NASW-2037)
(NASA-TT-F-14106; LAFE-174) Avail: NTIS CSCL 05K

Results are presented of a conference conducted on the programs, goals, and plans for the SACI Project. The three phases of the project discussed were: (1) Stanford University link via ATS-3 for seminars, lectures, classes, etc.; (2) broadcasting educational programs through audiovisual means to 500 schools in Rio Grande do Norte state utilizing ATS-F satellite to be launched in 1973; and (3) nationwide broadcasting through a Brazilian satellite. A.L.

N72-20960# National Science Foundation, Washington, D.C.
NATIONAL PATTERNS OF R AND D RESOURCES FUNDS AND MANPOWER IN THE UNITED STATES, 1953-1972
1972 40 p refs
(NSF-72-300) Avail: SOD $0.50

A concise overview of current and historical interrelationships and patterns of national scientific and engineering resources is presented. The R and D funding series begins with 1953, the first year for which survey data are available, and extends through 1972 with estimates for this year. Time series on R and D scientific and engineering manpower employed by each sector, covering the period 1954 to 1971, are also prasented. Author

N72-20961# Association Scientifique et Technique pour la Recherche en Informatique Documentaire, Ghent (Belgium).
DOCUMENTARY INFORMATION: A PHOTOELECTRONIC SOLUTION, THE SESAM SYSTEM [L'INFORMATIQUE DOCUMENTAIRE: UNE SOLUTION PHOTO-ELECTRONIQUE, LE SYSTEME SESAM]
Herman K. DeJaeger 1971 15 p refs In FRENCH; ENGLISH summary
(ASTRID-Ser-1) Avail: NTIS

Specifications and operational features are presented for SESAM (electronic system for automatic selection of microfilms). SESAM is a system which stores and automatically retrieves documentary information. The basic system consists of the following items of equipment: (1) a recording unit which photographs documents adjacent to one another on reels of photographic film; (2) a retrieval unit, a small third-generation special purpose computer with random access disk memory, which searches the film and selectively retrieves documents; (3) an electric typewriter/tape punch, which codes indexing and request information into the machine language on which the system operates; and (4) a selector-reader-printer device. Author

N72-20962# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
LIST OF PIBAL REPORTS, 1971
Jan. 1972 15 p refs
Avail: NTIS

This bibliography lists PIBAL (Polytechnic Institute of Brooklyn Aerospace Laboratory) reports, publications, and unpublished presentations related to the fields of aeronautics, astronautics, and applied mechanics. This compilation covers the calendar year 1971. Author

N72-20963# National Oceanographic Data Center, Washington, D.C.
MARINE SCIENCE NEWSLETTERS: AN ANNOTATED BIBLIOGRAPHY
Charlotte Ashby, comp. Mar. 1972 20 p refs
(NOAA-TM-EDS-NODC-2) Avail: NTIS

An updated bibliography of marine science and oceanographic newsletters is presented. The publication is in two parts: (1) newsletters listed alphabetically with each citation including title, name, address of publisher, frequency of publication, cost, and annotations regarding content and (2) alphabetical listing of publishers, indexed to the appropriate newsletters. A.L.

N72-20964# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
[REACTOR MATERIALS AND TECHNOLOGY] Annual Progress Report, period ending 30 Jun. 1971
Sigfried Peterson, ed. Sep. 1971 230 p refs
(Contract W-7405-eng-26)
(ORNL-4770) Avail: NTIS

The research accomplished during this period is reported. Topics discussed include: materials development for isotopic power programs, nondestructive testing for LMFBR, corrosion of steam generator alloys, cladding development, refractory alloys, electron microscopy, and oxide fuels. F.O.S.

N72-20965# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure
IMS DIVISION 1970/71: PROGRESS AND TREND OF CURRENT ACTIVITIES
Sep. 1971 38 p refs
(NPL-ISM-14) Avail: NTIS

The progress and achievements of individual sections (silicate materials, high temperature studies, interfacial studies, electron microscopy, composite materials, applied X-rays theoretical studies, polymer formation and characterization, and crystal growth pertaining to inorganic and metallic structure are summarized. The aim was to provide a review of the highlights and trends of current activities. ESRO

N72-20966# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TESTING GENERAL SUPPLIES AND EQUIPMENT Final Report
15 Sep. 1971 12 p refs
(AMCR Proj. 310-6)
(AD-734852; MTP-10-1-001) Avail: NTIS CSCL 15/5

The report provides background information relative to testing general supplies and equipment; Groups general supplies and equipment according to functional use; Identifies the items

of equipment considered to be in the category of food and food preparation; fuel; shelter; general and special purpose clothing; general and special purpose equipment; heating, cooling, and ventilation equipment; photographic and optical equipment; and miscellaneous support equipment for airdrop operations. Discusses experimental design, instrumentation techniques, safety considerations, statistical techniques, and data reduction. Provides a list of applicable common subtests. Author (GRA)

N72-20967# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
SURVEILLANCE, TARGET ACQUISITION AND NIGHT OBSERVATION (STANO) PHASE 1 SYSTEM ASSESSMENT MODEL (SAM). VOLUME 1: MODEL DESCRIPTION, PART 2 Final Report
30 Apr. 1971 551 p refs
(Contract DAAB07-69-C-0069)
(AD-734886; CAL-UM-2709-H-6-Vol-1-Pt-2;
USACDCSAG-TR-9-71-Vol-1) Avail: NTIS HC $6.00/MF $0.95
CSCL 15/7

The STANO Phase I SAM is designed to simulate a brigade or smaller STANO System in a low-intensity conflict. The model will permit the establishment and evaluation of numerous effectiveness criteria for individual STANO sensors and subsystems. It will facilitate the formation of improved candidate STANO Systems, through better understanding of shortcomings in organization, materiel and concepts of employment. It has the capability of producing information permitting scientifically supportable evaluations and judgments of interface requirements and trade-off options of STANO subsystems. The model can be used for parametric analysis, trade-off analysis, and system performance sensitivity tests. Author (GRA)

N72-20968# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. 15/7
SURVEILLANCE, TARGET ACQUISITION AND NIGHT OBSERVATION (STANO) PHASE 1 SYSTEM ASSESSMENT MODEL (SAM). VOLUME 2: USER'S MANUAL Final Report
30 Apr. 1971 304 p
(Contract DAAB07-69-C-0069)
(AD-734887; CAL-UM-2709-H-6-Vol-2;
USACDCSAG-TR-9-71-Vol-2) Avail: NTIS HC $6.00/MF $0.95

The manual is intended to help and guide the user in the preparation and proper program operation for the Phase I System Assessment Model (SAM) developed under Cornell Aeronautical Laboratory, Inc. (CAL) Project Mobile Army Surveillance System (MASS). Author (GRA)

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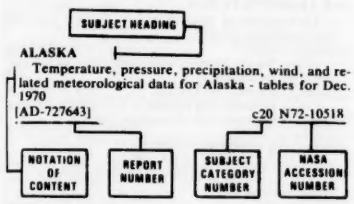

The subject heading is a key to the subject content of the document. The Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The subject category number indicates the subject category in the abstract section in which the citation is located. The NASA accession number denotes the number by which the citation is identified within the subject category. The NOC's are arranged under each subject heading in ascending accession number order.

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[NP-19061] c25 N72-20699
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[CEA-CONF-1863] c25 N72-20702
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[NASA-CASE-MFS-21042] c07 N72-20163
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[NASA-CR-115488] c31 N72-20827

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[NASA-CR-123549] c18 N72-20505
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[NASA-CR-72983] c18 N72-20508

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[NASA-TN-D-6658] c05 N72-20108
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[R-747-NIH] c04 N72-20067
BIOMOD - computer graphic system for interactive biochemical modeling and analysis
[P-4704] c04 N72-20068
Operators reference manual for BIOMOD computer graphics system
[R-746-NIH] c05 N72-20104
FORTRAN compatible software system providing interactive graphics capability for IBM 1800 computer
[NASA-TM-X-65859] c08 N72-20182
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[NASA-TM-X-67799] c21 N72-20594
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[NASA-CR-125887] c10 N72-20226
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[NASA-CR-122555] c15 N72-20448
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[NASA-TM-X-67660] c34 N72-20944
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[JUL-774-ZE-FF] c14 N72-20416
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[P-4696] c19 N72-20522
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[NASA-CR-102977] c31 N72-20820
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[NASA-TM-X-2507] c31 N72-20856
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Fabrication of root cord restrained fabric suit sections from sheets of fabric
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Stabilization of turbulent shear layer flow in rotating systems by coriolis forces
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Research and development of NATO countries in high temperature corrosion of aerospace alloys
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Sensor for detecting and measuring energy, velocity and direction of travel of a cosmic dust particle
[NASA-CASE-GSC-10503-1] c14 N72-20381
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Dourbes [Belgium] geophysical observatory data on geomagnetism, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during Mar. 1971
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Ionospheric sounding and cosmic ray neutron flux density tables, Dourbes, Belgium, Jul. 1971
c13 N72-20375
Elastic and inelastic collisions of strongly interacting elementary cosmic particles at high energies
[NASA-TT-F-686] c29 N72-20774
Evaluating capability of cosmic ray laboratory for investigating characteristics of high energy interactions
c24 N72-20781
Characteristics of large-size Cerenkov detectors for use in studying cosmic rays
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Mean multiplicity of volatile neutron as measure of cosmic ray energy spectrum diurnal variations
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Determination of cosmic radiation history and surface chronology of lunar soil and rock samples using etched particle track technique
[NASA-CR-115470] c30 N72-20795
COSMOLOGY
Motions of open star clusters and velocity of sun relative to open clusters
[PUBL-84] c30 N72-20801
COSMONAUTS
Systems used in Vostok and Voskhod spacecraft for protection of cosmonauts from radiation hazards
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COSMOS SATELLITES
Cosmos 243 data on microwave radiation from cultivated soil
[NASA-TT-F-14175] c13 N72-20364
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Aug. 1971
[ROE-STS-117] c31 N72-20894
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Sep. 1971
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Labor cost analysis for refurbishment of space shuttle system thermal protection
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Coupling effects between wall heating and axial pressure gradients in turbulent boundary layer flow
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Variable direction force coupler for transmitting reciprocating force along curved path
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Computation of potential flow around axisymmetric bodies, cowls, and engine inlets using singularity method
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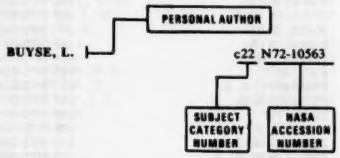

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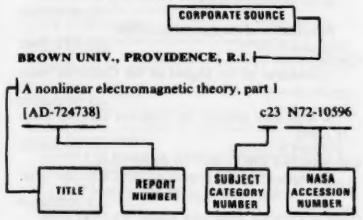

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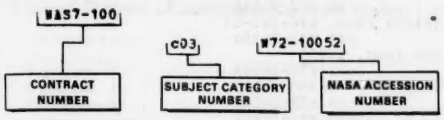

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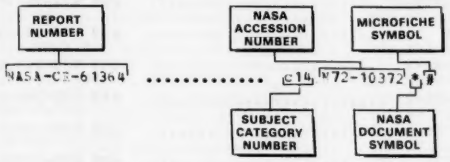

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NASA-CASE-ERC-10468 ..... c09 N72-20206*#

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NASA-CASE-GSC-10669-1 ..... c03 N72-20031*
NASA-CASE-GSC-11046-1 ..... c07 N72-20155*#
NASA-CASE-GSC-11074-1 ..... c14 N72-20391*#
NASA-CASE-GSC-11163-1 ..... c15 N72-20461*#
NASA-CASE-GSC-11239-1 ..... c10 N72-20233*#
NASA-CASE-GSC-11425-1 ..... c24 N72-20637*#
NASA-CASE-GSC-11487-1 ..... c14 N72-20404*#

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NASA-CASE-HQN-10697 ..... c03 N72-20037*#
NASA-CASE-HQN-10741 ..... c05 N72-20114*#

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NASA-CASE-KSC-10626 ..... c15 N72-20468*#
NASA-CASE-KSC-10639 ..... c15 N72-20467*#

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NASA-CASE-LAR-10318-1 ..... c14 N72-20396*#

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NASA-CASE-LEW-11015-1 ..... c26 N72-20730*#
NASA-CASE-LEW-11058-1 ..... c28 N72-20769*#
NASA-CASE-LEW-11087-1 ..... c15 N72-20464*#
NASA-CASE-LEW-11180-1 ..... c25 N72-20691*#
NASA-CASE-LEW-11359-2 ..... c03 N72-20034*
NASA-CASE-LEW-11402-1 ..... c28 N72-20770*#
NASA-CASE-LEW-11645-1 ..... c22 N72-20602*#

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NASA-CASE-MFS-18737 ..... c15 N72-20462*#
NASA-CASE-MFS-20242 ..... c14 N72-20405*#
NASA-CASE-MFS-20317 ..... c15 N72-20456*#
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NASA-CASE-MFS-20653 ..... c14 N72-20407*#
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NASA-CASE-MFS-20698 ..... c15 N72-20446*
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NASA-CASE-MFS-21042 ..... c07 N72-20163*#
NASA-CASE-MFS-21109 ..... c05 N72-20112*#
NASA-CASE-MFS-21362 ..... c11 N72-20252*#
NASA-CASE-MFS-21364 ..... c15 N72-20460*#
NASA-CASE-MFS-21372 ..... c14 N72-20397*#
NASA-CASE-MFS-21465 ..... c10 N72-20232*#

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NASA-CASE-MSC-12393-1 ..... c02 N72-20016*#
NASA-CASE-MSC-12398 ..... c05 N72-20098*
NASA-CASE-MSC-12408-1 ..... c13 N72-20355*#
NASA-CASE-MSC-12411-1 ..... c05 N72-20096*
NASA-CASE-MSC-12448-1 ..... c14 N72-20394*#
NASA-CASE-MSC-13407-1 ..... c10 N72-20225*
NASA-CASE-MSC-13436-1 ..... c05 N72-20113*#

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NASA-CASE-NPO-10671 ..... c15 N72-20443*
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NASA-CASE-NPO-10765 ..... c06 N72-20121*
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NASA-CASE-NPO-11203 ..... c10 N72-20224*
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NASA-CASE-NPO-11418 ..... c14 N72-20393*#
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20206*# NASA-CASE-NPO-11569 ..... c10 N72-20231*#
NASA-CASE-NPO-11593 ..... c07 N72-20162*#
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NASA-CASE-NPO-11612 ..... c11 N72-20251*#
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20442* NASA-CASE-NPO-11707 ..... c07 N72-20161*#
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20233*# NASA-CASE-NPO-11868 ..... c10 N72-20236*#
20637*# NASA-CASE-NPO-11880 ..... c28 N72-20766*#
20404*# NASA-CASE-NPO-12070 ..... c28 N72-20771*#
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20396*# NASA-CR-1967 ..... c15 N72-20452*#
NASA-CR-1985 ..... c12 N72-20322*#
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20456*# NASA-CR-112041 ..... c14 N72-20386*#
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20392*# NASA-CR-115460 ..... c07 N72-20142*#
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NASA-CR-125913 ..... c14 N72-20383*#
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NASA-CR-125917 ..... c25 N72-20681*#
NASA-CR-125919 ..... c31 N72-20818*#
NASA-SP-190 ..... c30 N72-20809*#
NASA-SP-204 ..... c04 N72-20048*#
NASA-SP-277 ..... c15 N72-20451*#
NASA-SP-5948(01) ..... c09 N72-20202*#
NASA-SP-8085 ..... c30 N72-20799*#
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NASA-TM-I-2448 ..... c01 N72-19991*#
NASA-TM-I-2506 ..... c31 N72-20847*#
NASA-TM-I-2507 ..... c31 N72-20856*#
NASA-TM-I-2508 ..... c31 N72-20871*#
NASA-TM-I-2509 ..... c31 N72-20880*#
NASA-TM-I-2510 ..... c16 N72-20477*#
NASA-TM-I-2526 ..... c33 N72-20924*#
NASA-TM-I-62143 ..... c12 N72-20272*#
NASA-TM-I-64640 ..... c08 N72-20181*#
NASA-TM-I-64645 ..... c17 N72-20494*#
NASA-TM-I-64646 ..... c21 N72-20586*#
NASA-TM-I-65834 ..... c30 N72-20797*#
NASA-TM-I-65852 ..... c24 N72-20631*#
NASA-TM-I-65854 ..... c29 N72-20784*#
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NASA-TM-I-65856 ..... c31 N72-20834*#
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NASA-TM-I-65859 ..... c08 N72-20182*#
NASA-TM-I-65861 ..... c31 N72-20836*#
NASA-TM-I-65865 ..... c29 N72-20788*#
NASA-TM-I-67650 ..... c13 N72-20370*#
NASA-TM-I-67651 ..... c31 N72-20814*#
NASA-TM-I-67652 ..... c11 N72-20247*#
NASA-TM-I-67660 ..... c34 N72-20944*#
NASA-TM-I-67661 ..... c14 N72-20382*#
NASA-TM-I-67667 ..... c30 N72-20810*#

NASA-TM-X-67671 ..... c30 N72-20803*#
NASA-TM-X-67799 ..... c21 N72-20594*#
NASA-TM-X-68301 ..... c30 N72-20812*#
NASA-TM-X-68818 ..... c11 N72-20245*#
NASA-TM-X-68819 ..... c11 N72-20246*#

NASA-TN-D-6599 ..... c06 N72-20128*#
NASA-TN-D-6625 ..... c33 N72-20923*#
NASA-TN-D-6629 ..... c02 N72-20006*#
NASA-TN-D-6658 ..... c05 N72-20108*#
NASA-TN-D-6675 ..... c04 N72-20071*#
NASA-TN-D-6683 ..... c30 N72-20806*#
NASA-TN-D-6707 ..... c02 N72-20008*#
NASA-TN-D-6709 ..... c08 N72-20188*#
NASA-TN-D-6710 ..... c02 N72-20011*#
NASA-TN-D-6724 ..... c31 N72-20845*#
NASA-TN-D-6725 ..... c31 N72-20841*#
NASA-TN-D-6730 ..... c17 N72-20492*#
NASA-TN-D-6737 ..... c31 N72-20846*#
NASA-TN-D-6738 ..... c31 N72-20842*#
NASA-TN-D-6739 ..... c31 N72-20844*#
NASA-TN-D-6741 ..... c31 N72-20843*#
NASA-TN-D-6745 ..... c15 N72-20457*#
NASA-TN-D-6748 ..... c14 N72-20399*#
NASA-TN-D-6754 ..... c02 N72-20012*#

NASA-TR-R-375 ..... c20 N72-20551*#

NASA-TT-F-604 ..... c04 N72-20039*#
NASA-TT-F-646 ..... c34 N72-20957*#
NASA-TT-F-669 ..... c34 N72-20942*#
NASA-TT-F-686 ..... c29 N72-20774*#
NASA-TT-F-691 ..... c12 N72-20310*#
NASA-TT-F-13953 ..... c17 N72-20493*#
NASA-TT-F-14106 ..... c34 N72-20959*#
NASA-TT-F-14132 ..... c16 N72-20478*#
NASA-TT-F-14149 ..... c13 N72-20359*#
NASA-TT-F-14150 ..... c09 N72-20204*#
NASA-TT-F-14152 ..... c29 N72-20786*#
NASA-TT-F-14161 ..... c14 N72-20400*#
NASA-TT-F-14175 ..... c13 N72-20364*#
NASA-TT-F-14191 ..... c18 N72-20511*#
NASA-TT-F-14193 ..... c23 N72-20615*#
NASA-TT-F-14199 ..... c18 N72-20510*#
NASA-TT-F-14206 ..... c02 N72-20014*#
NASA-TT-F-14207 ..... c04 N72-20074*#
NASA-TT-F-14208 ..... c01 N72-19993*#
NASA-TT-F-14210 ..... c26 N72-20732*#
NASA-TT-F-14217 ..... c26 N72-20731*#
NASA-TT-F-14218 ..... c13 N72-20357*#
NASA-TT-F-14219 ..... c13 N72-20358*#
NASA-TT-F-14220 ..... c13 N72-20356*#
NASA-TT-F-14222 ..... c23 N72-20614*#
NASA-TT-F-14223 ..... c22 N72-20601*#
NASA-TT-F-14224 ..... c22 N72-20600*#
NASA-TT-F-14230 ..... c02 N72-20015*#
NASA-TT-F-14233 ..... c26 N72-20733*#
NASA-TT-F-14234 ..... c13 N72-20360*#
NASA-TT-F-14242 ..... c01 N72-19994*#
NASA-TT-F-14264 ..... c06 N72-20129*#

NAVTRADEVCEN-70-C-0189-1 ..... c05 N72-20118 #
NAVTRADEVCEN-70-C-0309-1 ..... c05 N72-20116 #

NBS-SP-300-VOL-8 ..... c14 N72-20384 #

NBS-TN-582 ..... c06 N72-20126 #
NBS-TN-612 ..... c24 N72-20630 #
NBS-TN-714 ..... c22 N72-20599 #
NBS-TN-718 ..... c07 N72-20169 #

NCEL-TN-1198 ..... c11 N72-20268 #

NELC-TR-1776 ..... c07 N72-20171 #

NLL-BR-30068 ..... c12 N72-20269
NLL-BR-30072 ..... c07 N72-20136

NLL-CE-TRANS-5781-(9022.09) c26 N72-20724
NLL-CE-TRANS-5807-(9022.09) c08 N72-20174
NLL-CE-TRANS-5808-(9022.09) c08 N72-20175
NLL-CE-TRANS-5813-(9022.09) c14 N72-20377

NLL-CTO-777-(9091.9F) c25 N72-20679

NLL-DRIC-TRANS-2551-(3623.66) c07 N72-20136
NLL-DRIC-TRANS-2640-(3623.66) c12 N72-20269

NLL-LTI-734-7613 ..... c17 N72-20484

NLL-M-21262-(5828.4F) c17 N72-20486
NLL-M-21263-(5828.4F) c17 N72-20485
NLL-M-21265-(5828.4F) c12 N72-20270
NLL-M-21270-(5828.4F) c15 N72-20441
NLL-M-22059-(5828.4F) c24 N72-20628
NLL-M-22073-(5828.4F) c13 N72-20335
NLL-M-22078-(5828.4F) c20 N72-20538
NLL-M-22083-(5828.4F) c13 N72-20336

NLL-RTS-6783 ..... c06 N72-20120

NLL-TRANS-746-1025-(9022.401) c18 N72-20503
NLL-TRANS-746-1094-(9022.401) c17 N72-20484
NLL-TRANS-847-(9022.64) c15 N72-20440
NLL-TRANS-2750-(9022.81) c07 N72-20135
NLL-TRANS-2816-(9022.81) c07 N72-20137

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NLR-TR-71004-U ..... c32 N72-20910 #

NOAA-AWS-TR-212 ..... c20 N72-20557 #

NOAA-PAPER-5 ..... c20 N72-20553 #

NOAA-TM-EDS-NODC-2 ..... c34 N72-20963 #

NOAA-TM-NESS-33 ..... c20 N72-20555 #

NOLTR-71-131 ..... c16 N72-20483 #

NOTA-INTERNA-305 ..... c23 N72-20626 #
NOTA-INTERNA-312 ..... c16 N72-20482 #
NOTA-INTERNA-313 ..... c24 N72-20675 #
NOTA-INTERNA-318 ..... c24 N72-20676 #
NOTA-INTERNA-319 ..... c24 N72-20677 #
NOTA-INTERNA-321 ..... c18 N72-20520 #

NP-18145 ..... c25 N72-20717 #
NP-18187 ..... c25 N72-20719 #
NP-18340 ..... c23 N72-20624 #
NP-18471 ..... c25 N72-20718 #
NP-18503 ..... c25 N72-20722 #
NP-18504 ..... c25 N72-20720 #
NP-18948 ..... c24 N72-20653 #
NP-19016 ..... c04 N72-20077 #
NP-19052 ..... c24 N72-20647 #
NP-19059 ..... c25 N72-20692 #
NP-19060 ..... c25 N72-20703 #
NP-19061 ..... c25 N72-20699 #
NP-19069 ..... c22 N72-20603 #
NP-19072 ..... c25 N72-20716 #
NP-19073 ..... c25 N72-20714 #
NP-19076 ..... c25 N72-20715 #
NP-19078 ..... c11 N72-20262 #
NP-19083 ..... c25 N72-20696 #
NP-19085 ..... c24 N72-20670 #

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NPL-NAC-9 ..... c19 N72-20537 #

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NRC-TT-1531 ..... c09 N72-20208 #
NRC-TT-1533 ..... c06 N72-20132 #
NRC-TT-1534 ..... c26 N72-20737 #
NRC-TT-1536 ..... c09 N72-20207 #

NRL-7353 ..... c17 N72-20500 #
NRL-7360 ..... c17 N72-20501 #

NSF-72-300 ..... c34 N72-20960 #

NSMRL-670 ..... c04 N72-20089 #

NTSB-BA-71-3-ISSUE-2 ..... c02 N72-20021 #

NUB-2112 ..... c24 N72-20642 #

NYO-2150-75 ..... c26 N72-20743 #
NYO-3383-19 ..... c24 N72-20662 #
NYO-3504-60 ..... c26 N72-20750 #
NYO-4117-5 ..... c15 N72-20471 #
NYO-4202-1 ..... c14 N72-20427 #

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ONR/WHO-279 ..... c20 N72-20544

ONERA-NT-01-13-71 ..... c30 N72-20812*#
ONERA-NT-02-26-71 ..... c24 N72-20674 #
ONERA-NT-03-7 ..... c18 N72-20518 #

ORNL-TM-2713-REV-1 ..... c33 N72-20929 #
ORNL-TM-3529 ..... c24 N72-20660 #
ORNL-TM-3540 ..... c22 N72-20609 #

ORNL-4770 ..... c34 N72-20964 #

ORO-3098-14 ..... c26 N72-20742 #
ORO-3235-72 ..... c06 N72-20134 #

P-4487 ..... c34 N72-20952 #
P-4497 ..... c34 N72-20951 #
P-4514 ..... c34 N72-20945 #
P-4627 ..... c34 N72-20950 #
P-4631 ..... c13 N72-20354 #
P-4652 ..... c34 N72-20949 #
P-4655 ..... c20 N72-20550 #
P-4672 ..... c08 N72-20183 #
P-4685 ..... c12 N72-20312 #
P-4695 ..... c19 N72-20521
P-4696 ..... c19 N72-20522
P-4697 ..... c12 N72-20314 #
P-4704 ..... c04 N72-20068 #
P-4706 ..... c34 N72-20954 #
P-4713 ..... c12 N72-20313 #
P-4720 ..... c19 N72-20526 #
P-4730 ..... c08 N72-20185 #
P-4734 ..... c08 N72-20184 #
P-4735 ..... c34 N72-20953 #

PB-203999 ..... c07 N72-20172 #
PB-204869 ..... c02 N72-20029 #
PB-204879 ..... c02 N72-20030 #

PCD-TR-72-1 ..... c27 N72-20756*#

PC004R9401 ..... c27 N72-20756*#

PH-84 ..... c23 N72-20610

PI(NT)-472-129/71 ..... c33 N72-20933 #

PPG-112 ..... c25 N72-20681*#

PR-10 ..... c20 N72-20562 #
PR-16 ..... c24 N72-20673 #

PRRL-72-CR-3 ..... c23 N72-20612*#

PSU-IRL-SCI-385 ..... c06 N72-20122 #

PUBL-7 ..... c30 N72-20808 #
PUBL-84 ..... c30 N72-20801 #

PWA-4148 ..... c28 N72-20763*#

QPR-4 ..... c15 N72-20471 #
QPR-104-PT-5 ..... c10 N72-20241*#

QR-1-PT-1 ..... c20 N72-20541
QR-1-PT-1 ..... c20 N72-20572 #
QR-2 ..... c33 N72-20916*#
QR-4 ..... c22 N72-20598*#

R-640-CC/RC ..... c20 N72-20549 #
R-746-NIH ..... c05 N72-20104 #
R-747-NIH ..... c04 N72-20067 #
R-756-NSF ..... c34 N72-20948 #
R-785-NSF ..... c34 N72-20947 #
R-788-HEW/CHU ..... c34 N72-20946 #
R-846-NOAA ..... c20 N72-20548 #
R-1435-TR-6 ..... c18 N72-20516 #
R-8832 ..... c15 N72-20448*#

RA-92 ..... c07 N72-20139
RA-93 ..... c14 N72-20378

RAE-LIB-TRANS-1582 ..... c12 N72-20311 #
RAE-LIB-TRANS-1590 ..... c06 N72-20123 #
RAE-LIB-TRANS-1597 ..... c04 N72-20073 #
RAE-LIB-TRANS-1601 ..... c09 N72-20203 #
RAE-LIB-TRANS-1606 ..... c02 N72-20013 #
RAE-LIB-TRANS-1610 ..... c04 N72-20072 #
RAE-LIB-TRANS-1612 ..... c34 N72-20943 #
RAE-LIB-TRANS-1614 ..... c01 N72-19992 #
RAE-LIB-TRANS-1619 ..... c07 N72-20152 #
RAE-LIB-TRANS-1625 ..... c32 N72-20906 #
RAE-LIB-TRANS-1631 ..... c33 N72-20925 #

RE-422 ..... c02 N72-20009 #

REPT-2 ..... c31 N72-20834*#
REPT-8/71 ..... c14 N72-20429 #
REPT-9/1971 ..... c12 N72-20330 #
REPT-9G90-8 ..... c13 N72-20342*#
REPT-10/1971 ..... c01 N72-19996 #
REPT-18 ..... c18 N72-20507*#
REPT-44/1970 ..... c29 N72-20789 #
REPT-51 ..... c12 N72-20315 #
REPT-52 ..... c12 N72-20316 #
REPT-53 ..... c12 N72-20317 #
REPT-61 ..... c14 N72-20437 #
REPT-70-22-REV ..... c29 N72-20790 #
REPT-71-6 ..... c13 N72-20376 #
REPT-71-7 ..... c20 N72-20575 #
REPT-71-7.528 ..... c15 N72-20458 +
REPT-71-39 ..... c25 N72-20705 #
REPT-72-00207 ..... c02 N72-20020 #
REPT-82 ..... c30 N72-20807 #
REPT-83 ..... c30 N72-20807 #
REPT-124-VOL-16 ..... c20 N72-20539
REPT-125-VOL-16 ..... c20 N72-20540
REPT-456 ..... c10 N72-20239 #
REPT-472 ..... c14 N72-20402 #
REPT-712-091 ..... c03 N72-20035*#
REPT-717 ..... c10 N72-20235 #
REPT-718 ..... c25 N72-20690 #
REPT-719 ..... c26 N72-20735 #
REPT-876 ..... c12 N72-20320 #
REPT-877 ..... c04 N72-20069 #
REPT-888 ..... c12 N72-20321 #
REPT-891 ..... c28 N72-20765 #
REPT-907 ..... c06 N72-20125 #
REPT-908 ..... c28 N72-20764 #
REPT-916 ..... c15 N72-20453 #
REPT-1577 ..... c26 N72-20743 #
REPT-1598 ..... c26 N72-20750 #
REPT-2298(SER)1530 ..... c14 N72-20426 #
REPT-6545 ..... c14 N72-20390 #
REPT-8105-F-1 ..... c16 N72-20474*#
REPT-71007 ..... c12 N72-20271*#
REPT-089020-1-F ..... c30 N72-20793*#
REPT-2210414-2 ..... c14 N72-20401*#

RIFP-137 ..... c24 N72-20636 #
RIFP-138 ..... c19 N72-20529 #
RIFP-139 ..... c24 N72-20635 #
RIFP-140 ..... c24 N72-20634 #
RIFP-141 ..... c24 N72-20641 #

ROE-STS-117 ..... c31 N72-20894 #
ROE-STS-118 ..... c31 N72-20895 #

RPI-TR-MP-25 ..... c31 N72-20818*#

RPP/M-23 ..... c11 N72-20263 #

RR-20 ..... c33 N72-20926 #

S-44-1971 ..... c09 N72-20217 #

SAM-TR-71-44 ..... c04 N72-20088 #

SAR-7 ..... c28 N72-20760*#

SATPR-4 ..... c31 N72-20837*#
SATPR-6 ..... c31 N72-20838*#

SC-DC-714134 ..... c18 N72-20515 #
SC-DC-714278 ..... c33 N72-20930 #

SC-DR-710324 ..... c09 N72-20211 #

SC-R-713325 ..... c10 N72-20243 #
SC-R-713407 ..... c09 N72-20212 #

SC-RR-70571 ..... c26 N72-20748 #
SC-RR-710540 ..... c12 N72-20326 #
SC-RR-710560 ..... c24 N72-20667 #
SC-RR-710795 ..... c32 N72-20909 #

SCL-DR-71-0336 ..... c11 N72-20264 #

SC507.3AR ..... c30 N72-20796*#

SD-71-342-VOL-1 ..... c31 N72-20822*#
SD-71-346 ..... c31 N72-20821*#
SD-72-SH-0005 ..... c33 N72-20919*#

SIR(INS)-5 ..... c24 N72-20673 #

SLAC-TRANS-135 ..... c24 N72-20648 #

SM-66 ..... c19 N72-20530 #
SM-129/52 ..... c24 N72-20649 #

SR-385 ..... c06 N72-20122 #

SRCC-163 ..... c24 N72-20629*#

STB-72-5 ..... c05 N72-20117 #

STU-68-263/U-210 ..... c12 N72-20329 #
STU-69-198/U-126 ..... c24 N72-20646 #

SU-IPR-429 ..... c25 N72-20723 #

SZS-7/71-PT-1 ..... c04 N72-20083 #

S131-PR04-W187F2E ..... c22 N72-20598*#

T-72-AU-9016-U ..... c11 N72-20250*#

TB-76-PT-2 ..... c19 N72-20523

TECH-NOTE-116 ..... c20 N72-20544

TEES-9075-CR-71-02 ..... c32 N72-20898*#

THEMIS-UND-71-4 ..... c32 N72-20913 #
THEMIS-UND-71-5 ..... c32 N72-20914 #
THEMIS-UND-71-6 ..... c12 N72-20334 #

TID-3557-1970-SUPPL ..... c25 N72-20721 #
TID-24860 ..... c22 N72-20606 #
TID-25814 ..... c15 N72-20472 #
TID-25852 ..... c24 N72-20657 #

TR-EE-70-16 ..... c10 N72-20226*#

TR-2 ..... c13 N72-20342*#
TR-7 ..... c13 N72-20353*#
TR-50 ..... c04 N72-20092 #
TR-69 ..... c26 N72-20740 #
TR-72-016 ..... c26 N72-20725*#
TR-76 ..... c26 N72-20739 #
TR-229 ..... c02 N72-20013 #
TR-320-3004 ..... c05 N72-20099 #
TR-320-3006 ..... c05 N72-20100 #
TR-7109.534 ..... c15 N72-20447

TRITA-EPP-71-25 ..... c14 N72-20431 #

TRW-ER-7396-F ..... c18 N72-20508*#

TRW-13463-6001-R0-00 ..... c28 N72-20761*#
TRW-17683-6001-R0-00 ..... c13 N72-20340*#
TRW-17683-6001-R0-00-APP ..... c13 N72-20341*#

TSC-PD-064-18 ..... c07 N72-20173 #

TT-70-50117 ..... c34 N72-20957*#

UCLA-ENG-7140 ..... c04 N72-20092 #

UCRL-51013-PT-1-REV-1 ..... c04 N72-20081 #
UCRL-73059 ..... c11 N72-20265 #
UCRL-73222 ..... c14 N72-20420 #
UCRL-73230 ..... c23 N72-20622 #
UCRL-73236 ..... c14 N72-20421 #
UCRL-73335 ..... c26 N72-20752 #
UCRL-73432 ..... c24 N72-20669 #
UCRL-73484 ..... c08 N72-20194 #
UCRL-73505 ..... c04 N72-20079 #

UF/TN/A/4 ..... c12 N72-20308 #

UNH-7203 ..... c30 N72-20792*#

UR-3490-3 ..... c04 N72-20085 #
UR-00012 ..... c31 N72-20820*#

US-PATENT-APPL-SN-03418 ..... c15 N72-20446*
US-PATENT-APPL-SN-03696 ..... c10 N72-20224*
US-PATENT-APPL-SN-05114 ..... c06 N72-20131*#
US-PATENT-APPL-SN-10161 ..... c33 N72-20915*
US-PATENT-APPL-SN-15025 ..... c03 N72-20033*
US-PATENT-APPL-SN-17102 ..... c09 N72-20205*#
US-PATENT-APPL-SN-21364 ..... c15 N72-20460*#
US-PATENT-APPL-SN-21508 ..... c08 N72-20176*
US-PATENT-APPL-SN-24224 ..... c09 N72-20200*
US-PATENT-APPL-SN-27340 ..... c15 N72-20442*
US-PATENT-APPL-SN-41430 ..... c10 N72-20221*
US-PATENT-APPL-SN-50207 ..... c07 N72-20141*
US-PATENT-APPL-SN-57399 ..... c03 N72-20034*
US-PATENT-APPL-SN-59895 ..... c15 N72-20445*
US-PATENT-APPL-SN-61895 ..... c07 N72-20167*#
US-PATENT-APPL-SN-63383 ..... c08 N72-20177*
US-PATENT-APPL-SN-65840 ..... c10 N72-20225*
US-PATENT-APPL-SN-67730 ..... c15 N72-20456*#
US-PATENT-APPL-SN-84290 ..... c05 N72-20106*#
US-PATENT-APPL-SN-86417 ..... c07 N72-20163*#
US-PATENT-APPL-SN-90595 ..... c03 N72-20031*
US-PATENT-APPL-SN-103077 ..... c25 N72-20689*#
US-PATENT-APPL-SN-103091 ..... c15 N72-20463*#
US-PATENT-APPL-SN-136253 ..... c28 N72-20767*#
US-PATENT-APPL-SN-137913 ..... c05 N72-20114*#
US-PATENT-APPL-SN-139814 ..... c14 N72-20404*#
US-PATENT-APPL-SN-144958 ..... c09 N72-20206*#
US-PATENT-APPL-SN-145026 ..... c06 N72-20127*#
US-PATENT-APPL-SN-147997 ..... c15 N72-20455*#
US-PATENT-APPL-SN-153542 ..... c28 N72-20771*#
US-PATENT-APPL-SN-167719 ..... c16 N72-20476*#
US-PATENT-APPL-SN-170440 ..... c15 N72-20459*#
US-PATENT-APPL-SN-172807 ..... c07 N72-20162*#
US-PATENT-APPL-SN-173052 ..... c07 N72-20159*#
US-PATENT-APPL-SN-173190 ..... c05 N72-20113*#
US-PATENT-APPL-SN-175267 ..... c14 N72-20398*#
US-PATENT-APPL-SN-175852 ..... c25 N72-20691*#
US-PATENT-APPL-SN-177753 ..... c07 N72-20154*#
US-PATENT-APPL-SN-180683 ..... c10 N72-20233*#
US-PATENT-APPL-SN-180963 ..... c15 N72-20468*#
US-PATENT-APPL-SN-181023 ..... c15 N72-20467*#
US-PATENT-APPL-SN-181024 ..... c07 N72-20168*#
US-PATENT-APPL-SN-182399 ..... c07 N72-20155*#
US-PATENT-APPL-SN-189438 ..... c30 N72-20805*#
US-PATENT-APPL-SN-192101 ..... c10 N72-20236*#
US-PATENT-APPL-SN-192141 ..... c07 N72-20153*#
US-PATENT-APPL-SN-193671 ..... c32 N72-20905*#
US-PATENT-APPL-SN-193947 ..... c14 N72-20393*#
US-PATENT-APPL-SN-196399 ..... c07 N72-20161*#
US-PATENT-APPL-SN-196931 ..... c07 N72-20157*#
US-PATENT-APPL-SN-198362 ..... c14 N72-20391*#
US-PATENT-APPL-SN-199907 ..... c11 N72-20251*#
US-PATENT-APPL-SN-199957 ..... c10 N72-20231*#
US-PATENT-APPL-SN-199965 ..... c15 N72-20462*#
US-PATENT-APPL-SN-200040 ..... c05 N72-20105*#
US-PATENT-APPL-SN-200085 ..... c26 N72-20736*#
US-PATENT-APPL-SN-200682 ..... c07 N72-20158*#
US-PATENT-APPL-SN-200762 ..... c03 N72-20038*#
US-PATENT-APPL-SN-201904 ..... c15 N72-20464*#
US-PATENT-APPL-SN-202769 ..... c05 N72-20112*#
US-PATENT-APPL-SN-202806 ..... c22 N72-20602*#
US-PATENT-APPL-SN-203405 ..... c02 N72-20016*#
US-PATENT-APPL-SN-205047 ..... c15 N72-20461*#
US-PATENT-APPL-SN-205675 ..... c14 N72-20407*#
US-PATENT-APPL-SN-206266 ..... c24 N72-20637*#
US-PATENT-APPL-SN-206663 ..... c03 N72-20037*#
US-PATENT-APPL-SN-207211 ..... c07 N72-20156*#
US-PATENT-APPL-SN-209535 ..... c28 N72-20766*#
US-PATENT-APPL-SN-211411 ..... c11 N72-20252*#
US-PATENT-APPL-SN-212010 ..... c14 N72-20394*#
US-PATENT-APPL-SN-212165 ..... c14 N72-20392*#
US-PATENT-APPL-SN-212900 ..... c14 N72-20395*#
US-PATENT-APPL-SN-212977 ..... c15 N72-20465*#
US-PATENT-APPL-SN-213004 ..... c14 N72-20405*#
US-PATENT-APPL-SN-214089 ..... c14 N72-20406*#
US-PATENT-APPL-SN-218965 ..... c10 N72-20232*#
US-PATENT-APPL-SN-219806 ..... c28 N72-20770*#
US-PATENT-APPL-SN-220274 ..... c31 N72-20840*#
US-PATENT-APPL-SN-220785 ..... c11 N72-20253*#
US-PATENT-APPL-SN-224489 ..... c14 N72-20396*#
US-PATENT-APPL-SN-226476 ..... c10 N72-20240*#
US-PATENT-APPL-SN-226477 ..... c14 N72-20397*#
US-PATENT-APPL-SN-228150 ..... c05 N72-20111*#
US-PATENT-APPL-SN-229916 ..... c13 N72-20355*#
US-PATENT-APPL-SN-233519 ..... c28 N72-20769*#
US-PATENT-APPL-SN-235266 ..... c26 N72-20730*#
US-PATENT-APPL-SN-624611 ..... c09 N72-20209*#
US-PATENT-APPL-SN-701244 ..... c05 N72-20096*

US-PATENT-APPL-SN-745337 ..... c28 N72-20758*
US-PATENT-APPL-SN-751215 ..... c22 N72-20597*
US-PATENT-APPL-SN-770425 ..... c06 N72-20121*
US-PATENT-APPL-SN-785615 ..... c05 N72-20098*
US-PATENT-APPL-SN-789044 ..... c14 N72-20381*
US-PATENT-APPL-SN-811038 ..... c14 N72-20380*
US-PATENT-APPL-SN-839934 ..... c07 N72-20140*
US-PATENT-APPL-SN-857967 ..... c15 N72-20443*
US-PATENT-APPL-SN-860492 ..... c09 N72-20199*
US-PATENT-APPL-SN-869260 ..... c05 N72-20097*
US-PATENT-APPL-SN-873045 ..... c14 N72-20379*
US-PATENT-APPL-SN-880250 ..... c03 N72-20032*
US-PATENT-APPL-SN-880831 ..... c11 N72-20244*
US-PATENT-APPL-SN-887685 ..... c10 N72-20223*
US-PATENT-APPL-SN-889375 ..... c10 N72-20222*
US-PATENT-APPL-SN-889554 ..... c15 N72-20444*

US-PATENT-CLASS-2-2.1 ..... c05 N72-20096*
US-PATENT-CLASS-2-2.1 ..... c05 N72-20098*
US-PATENT-CLASS-23-209.1 ..... c15 N72-20446*
US-PATENT-CLASS-29-412 ..... c15 N72-20444*
US-PATENT-CLASS-29-426 ..... c15 N72-20444*
US-PATENT-CLASS-29-527.2 ..... c15 N72-20444*
US-PATENT-CLASS-29-624 ..... c15 N72-20444*
US-PATENT-CLASS-51-216 ..... c15 N72-20444*
US-PATENT-CLASS-51-320 ..... c15 N72-20444*
US-PATENT-CLASS-51-323 ..... c15 N72-20444*
US-PATENT-CLASS-60-254 ..... c28 N72-20758*
US-PATENT-CLASS-95-18 ..... c14 N72-20380*
US-PATENT-CLASS-100-299 ..... c15 N72-20446*
US-PATENT-CLASS-122-32 ..... c33 N72-20915*
US-PATENT-CLASS-123-102 ..... c11 N72-20244*
US-PATENT-CLASS-128-142.5 ..... c05 N72-20096*
US-PATENT-CLASS-128-402 ..... c05 N72-20096*
US-PATENT-CLASS-136-79 ..... c03 N72-20032*
US-PATENT-CLASS-136-81 ..... c03 N72-20032*
US-PATENT-CLASS-136-83R c03 N72-20034*
US-PATENT-CLASS-136-89 ..... c03 N72-20031*
US-PATENT-CLASS-136-100R c03 N72-20034*
US-PATENT-CLASS-136-166 ..... c03 N72-20032*
US-PATENT-CLASS-136-175 ..... c03 N72-20034*
US-PATENT-CLASS-137-81 ..... c05 N72-20097*
US-PATENT-CLASS-137-469 ..... c05 N72-20097*
US-PATENT-CLASS-138-178 ..... c15 N72-20445*
US-PATENT-CLASS-165-133 ..... c33 N72-20915*
US-PATENT-CLASS-165-155 ..... c33 N72-20915*
US-PATENT-CLASS-165-158 ..... c33 N72-20915*
US-PATENT-CLASS-165-161 ..... c33 N72-20915*
US-PATENT-CLASS-165-174 ..... c33 N72-20915*
US-PATENT-CLASS-176-86G c22 N72-20597*
US-PATENT-CLASS-178-69.5R c07 N72-20140*
US-PATENT-CLASS-179-15BS c07 N72-20140*
US-PATENT-CLASS-180-105E c11 N72-20244*
US-PATENT-CLASS-188-1B c15 N72-20443*
US-PATENT-CLASS-188-1C c15 N72-20443*
US-PATENT-CLASS-188-268 ..... c15 N72-20443*
US-PATENT-CLASS-200-81.9M c09 N72-20199*
US-PATENT-CLASS-210-212 ..... c03 N72-20033*
US-PATENT-CLASS-235-92CC c08 N72-20176*
US-PATENT-CLASS-235-92DE c08 N72-20176*
US-PATENT-CLASS-235-92DM c08 N72-20176*
US-PATENT-CLASS-235-92LG c08 N72-20176*
US-PATENT-CLASS-235-92R c08 N72-20176*
US-PATENT-CLASS-235-152 ..... c08 N72-20176*
US-PATENT-CLASS-244-155 ..... c03 N72-20031*
US-PATENT-CLASS-250-83.6R c14 N72-20381*
US-PATENT-CLASS-250-208 ..... c14 N72-20379*
US-PATENT-CLASS-251-129 ..... c15 N72-20442*
US-PATENT-CLASS-251-333 ..... c15 N72-20442*
US-PATENT-CLASS-260-544F c06 N72-20121*
US-PATENT-CLASS-264-22 ..... c15 N72-20446*
US-PATENT-CLASS-285-18 ..... c15 N72-20445*
US-PATENT-CLASS-285-345 ..... c15 N72-20445*
US-PATENT-CLASS-307-273 ..... c10 N72-20221*
US-PATENT-CLASS-307-288 ..... c10 N72-20221*
US-PATENT-CLASS-307-295 ..... c10 N72-20223*
US-PATENT-CLASS-307-313 ..... c10 N72-20221*
US-PATENT-CLASS-315-22 ..... c10 N72-20225*
US-PATENT-CLASS-315-25 ..... c10 N72-20225*
US-PATENT-CLASS-318-308 ..... c11 N72-20244*
US-PATENT-CLASS-318-327 ..... c11 N72-20244*
US-PATENT-CLASS-318-376 ..... c11 N72-20244*
US-PATENT-CLASS-324-77G c08 N72-20177*
US-PATENT-CLASS-324-83A c10 N72-20224*
US-PATENT-CLASS-324-85 ..... c10 N72-20224*
US-PATENT-CLASS-324-115 ..... c10 N72-20222*
US-PATENT-CLASS-324-132 ..... c10 N72-20222*
US-PATENT-CLASS-325-4 ..... c07 N72-20140*
US-PATENT-CLASS-325-38 ..... c07 N72-20140*
US-PATENT-CLASS-325-58 ..... c07 N72-20140*
US-PATENT-CLASS-325-321 ..... c07 N72-20140*
US-PATENT-CLASS-325-445 ..... c07 N72-20141*
US-PATENT-CLASS-328-16 ..... c10 N72-20223*
US-PATENT-CLASS-328-20 ..... c10 N72-20223*
US-PATENT-CLASS-328-38 ..... c10 N72-20223*
US-PATENT-CLASS-328-133 ..... c10 N72-20224*
US-PATENT-CLASS-328-166 ..... c10 N72-20223*
US-PATENT-CLASS-328-207 ..... c10 N72-20221*
US-PATENT-CLASS-329-161 ..... c07 N72-20141*
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